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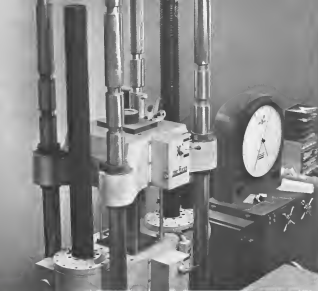
July 1, 1963

SPECIAL REPORTS:

- COIN T-37
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Interlocking: East manufacturers get closer to Europe by William H. Brinkley, Editor, World
 17-21 Jan 82, Washington, D.C. Manufacturers around the world are making dramatic gains in their access to Europe, and the U.S. is no exception. Indeed, the U.S. is now the only country that has gained access to the European market. The U.S. is now the only country that has gained access to the European market.

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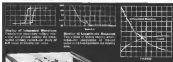
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Тема: «Углубление знаний о русском языке». В. В. ВЕРНИКОВ, канд. филол. наук, доцент кафедры русского языка, факультет филологии, Ярославский государственный университет им. П. П. Славянова

AEROSPACE CALENDAR

(Continued from page 51)

- [illegible]



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Radio command guidance, developed for the U.S. Air Force Atlas Program, has again demonstrated outstanding performance—guiding Atlas 158D to meet NASA's *Path 7* spacecraft precisely into the exact point in space for its 22 earth orbits.

Critical to the success of these Mercury missions are the precision, selectivity, and flight-path angle of the Mercury-Atlas vehicle as it places the craft into orbit. Measuring each of these factors with a precise tracking radar and three carefully positioned radio antennas, General Electric's radio guidance system sends commands to the airborne control system, and—at the exact instant at which all factors are computed to be correct—sends the signal for engine cut-off. So precise was the flight of Gordon Cooper's *Path 7* that it attained its near-perfect orbit at a velocity within 7 mph of the desired speed (over 27,500 mph).

Successful in its command performance at every Mercury-Atlas landing, General Electric's radio guidance system has also been selected to control launch of the modified Titan II vehicle and its Scout Gemini spacecraft. Such missions determine the accuracy, reliability, and system flexibility achieved by a continuing record on *Path 7* at General Electric's Radio Guidance Operation, Syracuse, New York.



AEROSPACE AND DEFENSE GROUP GENERAL ELECTRIC

COMMAND PERFORMANCE



THIS RECORDER WEARS TWO HATS

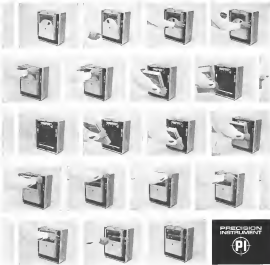
Practically every instrumentation tape recorder has two heads, but this is the only one that wears two hats. Wearing the first, it records and plays back in the conventional reel-to-reel manner. (Not *entirely* conventional, at that—the reels are uniquely stacked to provide at least a 2:1 saving in space over ordinary recorders).

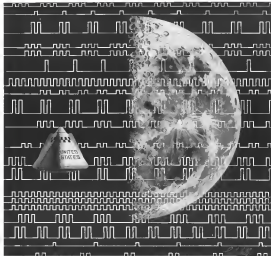
Wearing its other hat, the instrument becomes a continuous loop recorder (either fixed or variable) that will run circles around anything else you've ever seen . . . in such jobs as monitoring recording, repetitive analysis, and continuous recording and playback.

Changing hats is as simple as, well, changing hats.

Because the tape is housed in compact, interchangeable magazines, you need merely detach the first and snap the other into place, in seconds. No need to rewind or wait until the end of the reel: the interchangeable takes place at any time, any place on the tape.

We'd like to show you some of the many other useful features of the highly versatile PI 200 recorder. One of these features—its great economy of space and weight—will enable us to carry a 34-channel demonstrator into your laboratory in one hand. May we? For a copy of our PI-200 brochure, address us at: Stanford Industrial Park, Palo Alto 23, California.





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The PCM system requirements: Automatic in-flight self check analysis; permitting maintenance by the astronaut through use of replaceable modules; approximately weight 50 lbs.; accepts approximately one cubic foot; channels are parallel and serial digital input, high-level 0-3V and low level 0-40 mV analog inputs. Highly reliable qualified components are used throughout the system enabling highest MTBF to be achieved in mission performance.

Also, two 30 rack ground terminal on handling systems will serve as primary data reduction centers. One will handle data from the capsule and the other from Service's second stage booster.

Radiation engineers are experienced in complete systems development, and design for maximum effectiveness within a time project. The success of this project oriented approach has been demonstrated on operational programs such as Titan, Minuteman and Testar.

If you'd like to take part in future communications/telemetry communications, you'll find a challenging and rewarding opportunity at Radiation. Send your resume, or write for information. Personnel Director: **AN 072**, Boston, Melbourn, Melbourn, N.Y. Radiation is an equal opportunity employer.



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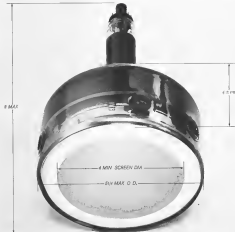
New compact storage tube for airborne applications

Hughes has developed a 5" diameter direct view storage tube with an overall length of 8" (tube envelope length = 4"). The Hughes H-102SA/P50 TONOTRON™ tube overcomes the severe size limitations inherent in airborne equipment. Designed with weather radar and terrain avoidance radar in mind, the H-102SA/P50 has both elegant design and reliable operation. It is now feasible to realize the advantages of high light output direct view fullframe storage tubes where before only standard cathode ray tubes could be used. While much smaller in size, the average performance characteristics of the Hughes compact TONOTRON™ tube are equal to or better than many larger 5" diameter storage tubes. It houses a 5" square direct view half-frame storage tube with electrostatic focus and magnetic deflection. 4" maximum useful screen diameter. On axis illumination.

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PERSONNEL DOSIMETRY

Where's the state of the art?

Take a look at just one more development — a reliable, low-level thermoluminescent dosimeter, which is near completion by EG&G under sponsorship of the U.S. Navy Bureau of Ships. Utilizing the thermoluminescent properties of magnesium-activated calcium fluoride, the TLD reliably monitors the range from 5mR to 10,000R. It is reusable and irradiated dosimeters can be stored up to two months without significant loss of dose data.



Used with its EG&G-designed Computer Indicator, the Navy's TLD will provide on-the-job, digital readout of exposure and 16 million different identification code numbers. When used with an automatic printer, it will generate the immediate, permanent documentation necessary for an effective radiation safety program.

This achievement demonstrates only one aspect of EG&G's state-of-the-art research and development capability in the field of applied radiation. The company's scientific and engineering staffs

currently provide a wide range of radiation services for both government and industry. In addition to several systems planning, they afford such specialized techniques as neutron calibration, flux mapping, chemical and glass dosimetry for gamma radiation experiments and neutron-spectrum and dose measurement with gold, sulfur, and fission foils/sensors.

EG&G's facilities include shielded radiation source ranges, radiochemical and radiation chemistry laboratories, X-ray and Van de Graaff accelerator machines, and laboratories for electronics, optics, physics and solid state research. These facilities are being expanded by the installation of a 4.59 Mev linear accelerator.

If more information on this and other EG&G capabilities is of interest to you, write us. Of specific interest to us at this time are resumes of scientists with backgrounds in physics, mathematics, or physical chemistry in the Ph.D. level, who are interested in applied research in the phenomenology of nuclear environments and the development of associated nuclear instrumentation. Write to: Elton Harris, Dept. MW-74, EG&G, Santa Barbara, Box 98, Santa Barbara, California. EG&G is an equal opportunity employer with equal opportunity in our fields.

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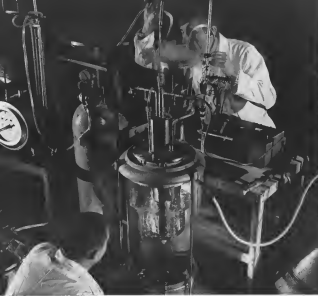
The unit shown is no ordinary A.P. transducer by Trans-Sonics, Inc. Drivers by compressed air only, it produces a 5.5 volt output over a midrange range of 0-30 mm/sec.

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Beech helps space vehicles get better mileage by turning "hot" fuel into icy slush

**Slush hydrogen experiment shows vital facet of
Beech's comprehensive systems management capability**

At the heart of this experiment at Beech's Boulder, Colorado, space center are three double-walled vacuum jars, each inside the other. Inside the inner jar is liquid hydrogen, while the center jar contains liquid helium. The outer jar is filled with liquid nitrogen. The idea is to further reduce hydrogen temperature until it turns to icy slush.

The purpose of this experiment is to explore the feasibility of reducing hydrogen volume in order to increase space vehicle fuel loads without increasing tankage size or weight.

Applied research projects like this are common at

Beech. In the past they have included valuable work on cryogenic problems, space environment, and countless other projects that have measurably advanced the state of the art.

Basic research and development is but one of an ever-expanding group of Beech space-age capabilities. Within the last year alone, the size and function of Beech space facilities has more than doubled. This constantly expanding capability complex, coupled with a highly trained and experienced staff, makes Beech a natural choice for systems management projects. Besides the experiment shown here . . .

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Cutting Transatlantic Fares

The opening gun of the counter-attack aimed at cutting transatlantic fares has been fired by Juan Trippe, president of Pan American World Airways (see p. 37). This campaign will reach its decisive phase during the late conference of the International Air Transport Association, scheduled for Salzburg in the Austrian Alps next September. We predict that the Salzburg conference will produce a coalition in retreat from the ill-fated decision of this same group last year at Chaudron, Asia, when a 5% increase was slapped onto transatlantic fares. It is even possible that the Salzburg conference may produce the largest reduction in the Atlantic fare since the start of the jet age.

'No Frills' Fare

Mr. Trippe, in effect, is trying to stir out good joy out of his competitors with his proposal of a new "no frills" transatlantic fare of \$190 one way from New York to London and a round-trip rate of \$370. This represents a reduction of 39% (\$185) to the current one-way economy class fare. For a round trip, it would slash \$190 from the present fare of \$561.

Some critics of the low-fare push on the Atlantic may wonder that Mr. Trippe's proposal is merely a publicity stunt in which he is also credit for being a champion of low fares while feeling sure that IATA will never let him realize the economic consequences by approving his suggested rates. We do not subscribe to this theory.

We think that Mr. Trippe is serious in his proposal and that his airline, or any other official transatlantic operator, can realize increased profits from the type service he proposes.

Let's look at the fare structure. Actually, Mr. Trippe's proposed third fare is still a cut above what airlines are already charging for transatlantic charter service—and we have never heard of airline companies about having success as charter operators. The Atlantic charter fares can differ among airlines and equipment, but \$275 round trip is a good average for a New York to Paris charter. The fact that the charter fare is popular with tourists and profitable for airlines is evidenced by the fact that this type of Atlantic business has tripled in the last five years to reach a volume of 315,000 passengers on 2,282 flights in 1962. There is no question that the charter business has broadened the air travel outlet in a most profitable manner. The point that is being made and more regular transatlantic passengers is why these charter groups can travel at a \$275 round trip fare while they must pay \$554 for a New York-Paris round trip, and why the airlines have recently had the economy to boost this regular

fare by 9%. The answer, of course, is that a full airplane can be operated profitably at the lower fare, while the regular traveler must pay the additional fare because of the airlines' inability to fill their aircraft often enough. We submit that this is miserably unfair, particularly since the Civil Aeronautics Board's liberal definition of a charter group has stripped all of the original meaning from this fare differential.

Mr. Trippe also proposes to form his new "frills-free" service of all meal and beverage service. This is no small economic factor, since Pan American now spends about \$12 million annually on cabin goods and TWA totals about \$10 million. We think most passengers would not be reluctant to skip the free meal service in return for \$191 more to spend as they please. If the prospect of six hours without a gourmet's snack is too appalling, there is always the solution developed by one of our British friends. Early in the fare spread between first class and economy, he made a practice of serving several breaded dollars each way across the Atlantic by performing an economic ticket and then serving a few pounds sterling at that superb London catering firm of Fortnum & Mason, for which they pocketed him a wider hunger of delicacies such as smoked salmon, game pie, roasts, tarts, and such white wine and a spot of after-dinner brandy. He then ate this much contentedly in his economy seat—and seldom did the first class meals surpass his Fortnum & Mason fare.

Puerto Rico Experience

The Pan American proposals are also based on some sound operating experience on the Puerto Rico run, where first class has virtually disappeared and the long-term trend of lowered fares has been matched by a sharper rising curve of increased traffic.

There are sure to be some bitter debates at the Salzburg IATA fare conference over Pan American's proposals. But we think that the invading public's reaction to the fare boost at Chaudron has been sharp enough to make even the most unreasonable airline arrangements into an overture that the only way Atlantic fare can go is down. Pan American is certainly not the only Atlantic operator to push hard for lower fares. There are several European carriers who share this view. With the strong backing of the U.S. Civil Aeronautics Board and the American Traveling Public, which contributes 65% of the Atlantic travel dollar, we expect that the case of the low-fare airlines will prevail at Salzburg and 1964 will be a business year for the transatlantic carrier as a result.

—Robert Hots



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Washington Roundup

RS-70 Victor: McNamara

Defense Secretary Robert S. McNamara has just about won the RS-70 fight with Congress. The victory is mostly attributable to technical and political events unrelated to the USAF's North American RS-70 study.

President Kennedy's determination to develop a supersonic transport (see p. 36) overrides the argument that such a development would provide more valuable technology than would an expanded RS-70 program. This, coupled with McNamara's assurance that some advanced bombers were in the works, weighted the technical scales in his favor that the House had voted several times by providing no additional money for the RS-70. First detailed study of aircraft to follow existing bombers is expected to be completed by the Air Force this month.

Political background of the non-authorized RS-70 vote was a desire by many conservatives in Congress to get even with Chairman Carl Vinson of the House Armed Services Committee for helping to enlarge the House Rules Committee, making it easier for liberal bills to reach the floor for a vote. Rep. Vinson is the leading advocate of an expanded RS-70 program, but could afford so few votes that he was out of town rather than witness certain defeat when the appropriations bill reached a vote. This was one more example of the overwhelming power of the "Swing East" in the House.

Rep. Vinson may make a last stand for an expanded RS-70 program if his fellow Georgian-Chinese Richard B. Russell of the Senate defense authorization and appropriations committees—grits the Senate to add RS-70 money to the House-passed bill. But odds are the House would succeed in knocking out the money in the House-Senate conference on differences.

Army Aviation's Future

Swift Strike 3 exercises starting in North and South Carolina this month will help determine the role aviation will play in the Army and what aircraft will be used. USAF's Lockheed C-119 Hercules and Fairchild C-119B Provider aircraft will compete against Army's de Havilland CV-340 Caribee in assault transport operations using rough fields.

Other major contests will pit USAF jet fighter-bombers against a fighter version of the Army's new OH-13A Mohawk in close troop support, and USAF slow patrol aircraft against Army scout helicopters in unconventional warfare exercises.

Field headquarters for the exercises to be conducted between July 21 and Aug. 16 will be Spartanburg, S. C. Army Gen. Paul D. Adams, commander of the U. S. Strike Command, will supervise the analysis of results. The contest is expected to be completed late this year, and will help decide the aircraft money USAF and Army will get in the fiscal 1965 defense budget.

Aeroflot in Conquary

Crashing of the Cuban airliner has been accompanied by the Soviet Union giving permission to use the Conquary airport in Georgia on its Moscow-to-Havana run. Russian airlines Aeroflot Tu-114s no longer extra fuel tanks and extra month before previously, since the Conquary-Havana leg is 4,670 mi compared with 5,310 mi from Moscow to Havana against the prevailing westerly winds. The latter route will be used on the return trip to take advantage of the winds. Service was to begin last week.

Russia, which helped finance the Conquary airport, had been denied permission to use it until recently.

Defense Dept. is now letting the civilian spot agencies tell the public much of what is making trouble about Russian spot failures. The policy change came after the House (present) education subcommittee unveiled Defense Dept. and National Aeronautics and Space Administration officials for not releasing information that Russia's latest plane, the AN-225 (see p. 37).

NASA's latest Satellite Situation Report, issued last week, declared that a Russian space launch Oct. 24 put 24 shawls into orbit apparently due to the explosion of a spacecraft headed for Mars. (Soviet Mars spacecraft was launched Nov. 1, but its radio failed Nov. 21 (AW Sp. 27, p. 20).

TFX Understatement

Chairman George Milson of the House Defense Appropriations Subcommittee contends "it is not possible to prove conclusively that the Secretary was right in that he was wrong" in opposing the TFX contract to General Dynamics after the military had recommended Boeing. But Sen. John L. McClellan is still going to his. His TFX hearings will not end anytime soon, and will include a close look at the conflict-of-interest possibilities arising from the legal work, Deputy Secretary, Russell L. Gilpatrick did for the TFX competition while out of office. Rep. Milson himself will be joined with McNamara that the Boeing design "is more complicated."

Defense Dept. research and supporting director Harold Brown, whose lack of political experience with aircraft and other military hardware after he has been dismissed, has been taking notes regarding flying lessons at Ft. Belvoir, Va., about once a week.

—Washington Staff

Space Budget Cut of \$490 Million Urged

Home unit seeks \$259 million slash in manned flight, \$120 million from Apollo; Edwards closing asked.

By Alfred P. Akkand

Washington—Home space committee last week decided to cut \$490 million from the National Aeronautics and Space Administration's \$1.7-billion budget request for fiscal 1969, and recommended that one of the agency's centers—the Flight Research Center at Edwards, Calif.—be closed when the X-15 flight program is concluded in 1965.

Largest reduction in the overall cut of nearly \$500 million forecast by Associate Wren & Swazey Transportation in March (ENR 8/5 p. 30) was the \$259 million slashed out of the manned flight budget request. Of the \$107-million reduction in funds sought for manned flight research and development, \$120 million was cut from the \$1.2 billion asked for Project Apollo, the manned lunar landing program.

In recommending that NASA close the Flight Research Center by closing the end of the X-15 rocket plane flight program in fiscal 1965, the subcommittee report stated that FRC personnel are being required to perform assigned by other NASA center report said that the subcommittee "does not intend to use the number of salaried orders of personnel at FRC . . . simply to estimate a work load."

This is a breakdown: by NASA program office, at the \$490-million cut: **Manned flight program, \$153,700,000** reduction in research and development funds and a \$75,822,000 reduction in construction funds; **Space station, \$202 million** cut in research and development funding and \$7.7 million reduction in facilities; **Advanced research, \$18.5 million** cut in research and development request and a \$30.5-million reduction in construction funding.

Applications satellites and tracking, a total reduction of about \$85 million has been agreed upon, but final construction action on this portion of the authorization is not expected before July 8. The committee report indicated the program was very important and was well ahead of the launch date. Since then, however, it indicated were determined as research or construction projects. There is no indication when the bill will go to the House.

Senate space committee has not completed its work on the NASA reauthorization bill. However, members of the committee have told NASA leaders that the agency's budget would be cut substantially.

Manned space flight subcommittee of the Apollo report was cut because "the use of the amount in question could not be clearly identified. This was particularly true in connection with development of the command and serv-

ices. The subcommittee said the use of program request, together with the budget request, existing under other government agencies . . . should make it possible to find this project at the level of \$11 million.

Another big reduction in the manned flight research and development budget was the \$25 million cut from the \$83 million requested for checkout and integration at Apollo, more of it for the services of General Electric Co. "NASA would not so quickly how much would be required for GE," the subcommittee report said. "NASA requested a minimum of \$180 million and a maximum of \$125 million. The NASA estimate on what would be done with the balance of \$13 million was also vague and uncertain. The subcommittee, therefore, recommended the elimination of the balance."

Most of the cuts in construction funding in the manned flight program involved a reduction for the closing flight was either data elimination of projects. Of the \$30 million cut from construction requests, \$10 million was the only major reduction at the Manned Spacecraft Center.

Atmospheric research and structure in the manned flight program was \$15.6 million to \$5.0 million; **Low Earth Orbiter** module test facilities, cut from \$15 million to \$1.5 million.

From reduced or eliminated in the manned flight program were the \$10 million for the construction of the Marshall Space Flight Center, include \$10 million for the \$10 million asked for M-1 engine test facilities, and elimination of \$2.5 million for computer facilities program and \$1.9 million for propulsion and vehicle laboratory extension.

Construction request for facilities at the Launch Operations Center, Cape Canaveral, was reduced a total of \$12 million. Major items were \$2.4 million cut from a request of \$21.7 million for the Saturn S launch complex, \$1.5 million for a new equipment for a new equipment, and \$1.5 million for a launch equipment shop, \$505,000 for an electrical and optical component testing shop, and \$1.5 million for a vehicle maintenance and servicing facility.

Reduction in the space station budget request was the elimination of the \$28.2 million Service lunar orbiter program. Dr. Elmer E. Newell, director of NASA's Office of Science, told the committee, only as the hearings (AW Mar. 4, p. 25) that the Service lunar orbiter program was under study and that the agency was considering "whether it is a cut . . . to include a Service lunar orbiter . . . or . . . to phase

out the photographing of the moon and the visual observation of the moon into the manned program line."

A week later, Newell told the committee NASA had decided to cancel the Service lunar orbiter program.

House space subcommittee, in recommending elimination of the project, and that NASA had neither clearly defined the need for Service lunar orbiter nor published its agency. The report pointed out that Fiscal 1962 and 1963 Service orbiter funds were reprogrammed to other uses.

Space station subcommittee report concluded that the need for Service was questionable, since NASA is obtaining several other series of orbiting photographs for large series of the moon. These alternatives, the subcommittee said, are Manned Spacecraft Center proposals for an Apollo lunar reconnaissance orbiter, a manned lunar orbit flight in 1967 (AW Mar. 25, p. 14) and a new light-weight stabilized photo reconnaissance spacecraft.

This last alternative is under study at the Langley Research Center. It involves use of an Apollo II in a lunar orbit spacecraft.

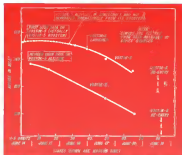
House space committee also adopted a space station subcommittee recommendation that \$15 million for a Mariner flyby of Venus in 1965 be eliminated in view of the interstellar flight of Mariner 2 and the question about the need for more data.

Ranger program was cut a total of \$12 million—\$10 million from the request for landing Ranger 15, which the report states subcommittee staff has been approved by NASA by management, and \$15 million from the \$50 million asked for fabrication of Ranger 11 and 14 by Northrop.

Subcommittee report said it recommended the \$15 million cut "to indicate its present lack of confidence in the Ranger project."

In other space program areas, the committee eliminated \$4 million for "follow-on unmanned satellites," and specifically approved program favorably negotiated with other countries are permitted, not \$14 million from the \$41 million requested. The committee also approved a program because of similar services by other government agencies, and reduced funds for launch vehicle technology from \$5 million to \$2 million.

Reductions in unmanned research program included deletion of an \$8.6 million advanced Project Fire—early testing experiments at velocities far out from planetary missions, a reduction of \$1 million in the \$12 million for the advanced research program, and a \$9-million reduction in the \$56.7 million asked for Project Rover "because of the falling AEC reactor development program."



PLOT OF VOSTOK 5 AND 6 apogee altitudes show Soviet data, indicates that original mission plan went over when Vostok 5 separated prematurely from booster and orbit at a lower altitude than intended (AW June 24, p. 14). U.S. tracking data indicate that Vostok 5 actually went to higher altitude than originally intended with altitude which Soviet has estimated for spacecraft but later revised. Detail line shows that 4 millionths had not occurred, altitude of Vostok 5 would have increased steadily with that achieved 48 hr. later by Vostok 6. Failure of Soviet to change Vostok 6 orbit to coincide with that actually achieved by Vostok 5 suggests there was not sufficient time to change Russian program. Not apparent from graph is fact that Vostok 6 was launched about 11 hr. before Vostok 5 was directly over launch site. The graph certainly has that Soviet launched Vostok 6 only to avoid any possible appearance of attempting to achieve to over Vostok 5 mission.

Theory of Premature Vostok 5 Separation Is Backed by NASA

By Philip J. Klein

Washington—Official confirmation that the Soviet Vostok 5 booster failed at a significantly higher orbit altitude than the spacecraft itself, suggesting premature spacecraft separation is reported by Associate Wren & Swazey Transportation (ENR June 24, p. 30), came last week in the latest edition of the Soviet Situation Report issued by the National Aeronautics and Space Administration.

The variation between the figure that the Soviet had announced and the actual figure was 5.1 m (15 ft). This compares with a difference of 10 m between booster and spacecraft reported by Soviet, based on launch signals achieved at that stage of the mission.

NASA scientists who have analyzed tracking data from Vostok 5 and 6 have found no evidence of any at-

mapped maneuvering in other spacecraft.

The only logical explanation for the Vostok 5-6 mission it was carried out as a view of the mutual position of the Vostok 3 and 4 a year ago, as the theory advanced by Vyacheslav Vozniak and Sergei Tsukovskoy, according to new NASA officials.

The assumption that Vostok 5 ended up in a lower orbit than intended and that Soviet scientists were not able to change the booster guidance system of Vostok 6 is true to make it to be placed at Vostok 5's altitude. After nearly ten days of independence over the sea, the failure of Soviet space technology, Russian scientists finally left again launching Vostok 6 as a slightly different orbit, which would be the most optimal for a crossing path for freeing maneuvers, thus during each orbit.

This enabled the Soviets to claim that the two spacecraft were close, thus Vostok 3 and 4, without explain-

ing that the interval of proximity was extremely brief.

A plot of the orbital altitude of Vostok 5 and 6, based on Soviet data, strongly indicates that the mission did not go as planned (see chart). If Vostok 5 had achieved the orbital altitude that the Soviet first announced, which was the altitude actually achieved by the booster, the spacecraft's altitude would have matched closely the upper which Vostok 6 achieved 100 days later (see dotted line on chart).

Because the Soviets knew the actual orbital parameters of Vostok 5, at the time that Vostok 6 was launched, it is difficult to explain why there would be a difference in altitude at a higher level, except, corresponding to the orbital parameters figure for Vostok 6, it had been possible on the true available as against Vostok 5 to be injected at the Vostok 5's altitude.

At a Moscow press conference, Col. Valeri B. Belyakov, Vostok 5 pilot, stressed that the flight of both Vostok

5 and 6 had been carried out exactly according to schedule and that both he and Valentina Tereshkova, in Vostok 6, had fulfilled all the tasks assigned to them.

Data on the orbital parameters of Vostok 5 and 6 in the NASA Satellite Situation Report, and supplemental data released by the agency, bring us the following conclusions: Vostok 5, launched by as much as 15 m (50 ft.) from agency figures released by USSR, with smaller discrepancies in the perigee figures.

The mission became smaller as the mission progressed, suggesting it occurred from an insufficient rate right away. Because the apogee occurred over the Russian land mass, where the Soviet network has few if any stations, it is to be expected that there would be larger errors in apogee data, closer to mid.

However, a plot of U.S. data supports the conclusion evident from the plot of Soviet data.

Cosmonauts Describe Flights, Experiments

By Stewart Ramsey

Moscow—Flight programs of Soviet cosmonauts for and so called for frequent observations of the orbits of their spacecraft both in formation flight and the distance between the two ships changed from five to several hundred kilometers during flight, USSR, mission.

This was reported at a press conference held in Moscow June 27 and attended by cosmonauts Valeri Tereshkova and Valeri Belyakov and Russian space specialists.

There was no reference during the conference as to whether an attempt was made to achieve a docking of Vostok 5 and 6 and the description of the cosmonauts' missions did not include this in the flight program.

Spacecraft Debut

Both cosmonauts appeared to be in good health. It was brought out that:

- Vostok 5 and 6, launched at the same as previous spacecraft in the Vostok series, adopted in one for a woman and at the other for a man. They traveled above five feet, as have previous Vostoks.
- Miss Tereshkova's flight program called for a 28-day flight with a possible extension up to three days.
- While it is still too early to draw firm conclusions, preliminary information has not yet been completely processed, Belyakov reported he felt an unpleasant numbness and Miss Tereshkova experienced no disturbances of motion. There were no appreciable dis-

turbances of cardiac activity in either man.

• Cosmonauts described their stay in space as comfortable. There were no problems in radio and TV contact of the spacecraft.

• Flight programs, for the first time provided for a number of scientific observations to be carried out along with medical and biological studies of the cosmonauts themselves.

Future Spacecraft

Martin V. Keldysh, president of the USSR Academy of Sciences, and the Vostok spacecraft as a foundation (also based on previous) of future human ships for long space voyages, atmospheric orbital stations, and manned scientific laboratories in space in which scientists will continue the study of the universe. Keldysh said that the Soviet space exploration program serves personal purposes, but that, when asked how soon Western cosmonauts will be allowed to attend Soviet space launches, he replied by saying that the Soviet Vostok would about five years compared with two years for American capsules and that they flew through the atmosphere.

Previous spacecraft could also be used to carry war materials, he said, without losing specificity that the Vostok line this capability. He said the Soviet Union could not deny events that are behind its military strength.

"When there will be no guarantee of peace, Western cosmonauts will not our launches," he said.

Keldysh said also that "We think

that the first interplanetary [manned] flight is not too far off."

Professor Vladimir Yevlovskiy, prominent Soviet space medicine specialist, and the Vostok-Tereshkova flights were preceded by extensive research in field better methods of recording physiological functions of humans and of improving conditions in the cabins of spacecrafts.

A part of the metabolic hygiene system of the ship's microclimate problems of personal hygiene and environment and water supply, he said. Soviet scientific research with his colleagues for the Vostok flight on basis of anatomical and physiological features of a woman. In particular he said, a new system of access for recording respiration and cardiac activity were needed as was special research about possible dehydrations effects on women.

Scientific Tasks

The main scientific tasks of a micro-ecological study for cosmonauts in flight and in were described by Yevlovskiy.

- Further investigations of prolonged flight on humans organisms.
- Investigation of physiological possibilities and work capability of man in a condition of continuous weightlessness in combination with other flight factors.
- Investigation of women's reactions, specifically in space flight conditions.
- Further investigations of diurnal physiological processes in a spaceflight environment.
- Investigation of the effectiveness of

selection and special training of cosmonauts.

• Investigation of the operation of medical-biological control of the condition of the cosmonauts and the microclimate of the capsule.

• Investigation of the effectiveness of operation of life support and safety systems.

Methods used for analyzing conditions of the cosmonauts included cardiography, pneumography, electroencephalography, electrocardiography and skin pH-metry recording, Yevlovskiy said.

Physiological information was transmitted by telemetry whether the cosmonaut's pulse count was obtained through a special channel of a "vital" radio transmitter which operated continuously.

Yevlovskiy said a specially worked out "Cosmonaut" in combination with radio communication fitted to a certain nature of the space and time, but previously had existed between doctrine on earth and the cosmonauts. Thus, heart activity was checked by pulse frequency, by EEG, respiration and pneumography, by breathing was checked by changes in chest perimeter as conditions of calm and during speech, Yevlovskiy said.

Psychomotor activity was checked by a number of indices including an analysis of speech tests, and speaking dynamics of movement of the free and eyes, disorientation on electronic psychographs and by spontaneous changes of circadian rhythm to give way current of the day.

Yevlovskiy said reflection checking was carried out by physical and biological observation. A total dose of radiation for 16 days was given as 35 millirads and for Miss Tereshkova as 25 millirads. He said both Belyakov and Miss Tereshkova experienced dropped up heartbeat as the pulsation period and heart rate returned local self.

Yevlovskiy and Belyakov selected himself from his knees and floated freely in the spaceship on his 16th, 18th, 20th and 26th orbits and carried out a work program. He made random movements and changed positions without using any vestibular disturbances or perturbations of turns.

He had a good appetite during the entire flight and slept well with no difficulties. His work capacity remained at a sufficiently high level.

Yevlovskiy said that while Miss Tereshkova's flight was postponed at one day, satisfactory conditions persisted it to be continued for three.

Her menstrual tissues were removed, he said which also established her work capability. She performed physical exercises and also acted as usual personnel.

Belyakov's pulse frequency in flight

Soviets Plan Manned Circumnar Flight

Moscow—"Chief designer" of the Vostok spacecraft has admitted that Soviet scientists will use earth orbit maneuvers to accomplish an early manned circumnary flight.

In an article given with cosmonauts in Pravda and other Soviet newspapers, the controversial "Chief designer" admitted that the flight of Lt. Col. Valeri Belyakov and Valentina Tereshkova (AP Wirephoto June 24, p. 1) were the second priority in such a mission. He did not indicate when the manned circumnary flight would be made.

President reports that the Soviet Union will undertake a manned lunar flight program with its existing bases, which U.S. officials receive serious doubts has a threat of about 1 billion lbs., is based on the assumption that the Russians will develop propulsion stages and spacecraft in earth orbit.

The U.S. does not plan a manned circumnary flight until 1967 (AP Wire June 15, p. 34).

The chief designer said that a circumnary flight might take eight to 12 days and it would be necessary to predict all technological aspects of providing life support for the crew.

As with the previous Nikolayev-Popov flight, the post flight of Vostok 5 and 6 raised many scientific and technical problems, he said (see p. 21). Of particular importance were complex biological experiments, including the problem of how well man could stand up in a continuous period of weightlessness.

Experiments show that after the first day of space flight, man gets accustomed to weightlessness both physically and psychologically," the Pravda article quoted him as saying.

The chief designer and participants of the lunar mission was "very interested," because previous cosmonauts were just trained and accustomed to overboard and high speeds, whereas Miss Tereshkova's only experience with earthwork was in space training.

"It is now clear that the problem of training cosmonauts is solved," he said. "We do think in space it will be easier."

Questioned about cosmonauts in space, the chief designer replied that the problem of cosmonauts and docking of spacecraft is "on the agenda" of space exploration. He said that the flight of the Nikolayev-Popov or Belyakov-Tereshkova flights involved in total attempt at docking.

The solution to the cosmonauts and docking problem, he said, would allow cosmonauts to bring orbital stations to serve both the cosmonaut program and to space landing stages to serve other space vehicles.

He said that the next step would be to develop a landing system, he said. "This means that in all cases one of the lander does not work, movement of the ship will be needed by means of the atmosphere, and it is a completely different task will return to earth. The question is only the time and place of landing."

Of the high speed landing stages and problems of high speed will point out the fact that it is not that simple to expect cosmonauts, he said.

The chief designer and the question of space stations "undoubtedly" in lunar area during the moon. He added that while such a flight was "extremely interesting," it was also "very difficult." He said, "such a flight is complicated but returning from the moon to earth is even more so."

He said that he is sure that manned flight to the moon is not far off, but that a practical solution to this task would probably require "more than one year."

Oxygen concentration did not exceed 20% and carbon dioxide concentration did not exceed 0.5% under normal breathing pressure.

As a result of the flight of Belyakov and Tereshkova, a vast amount of scientific material has been obtained and much time will be needed to process it and summarize it," Yevlovskiy said.

He added that there is no doubt that the results obtained on a great scale advance in the mastering of cosmic space.

Academy of Sciences, USSR, head of the Soviet Academy of Sciences, Dept. of Terrestrial Sciences, and that there is the flight a thorough observation of the sun was reported from astronomical observations. A vertical section of the upper atmosphere was

shed such geophysical models to obtain the correct conditions there.

Outstanding features of the current flights in comparison with the earlier ones were listed by Bregman as a considerable expansion of audio-visual research and the introduction of external representations in the system to provide external models for human activity that permitted the experimenters to describe their state as "life in comfort."

Bregman said that whereas in previous flights, human attention was concentrated on the flight's effects on man, there was also emphasis in the latest flights on carrying out a number of scientific observations such as the collection of constellations, photographing the sun, photographing the face of the earth at daybreak and sunset and carrying out visual and optical observations of the surface of the earth.

Bregman said that there were some changes in the criteria of transmission of information among radio communications.

He said the improved reception on the ground was made possible by the fact that from time to time signals received in several reception points were presented to transmitters before and amplified signals were transmitted by land lines to the Moscow television center and then to the television and radio systems by cable lines and radio.

Problems of uniform illumination of the space station was solved so that there would be no reduction in television lighting when the cosmonaut left his seat, Bregman said. Additionally, there was an automatic brightness adjustment to automatically changing light conditions and special lenses were used. There also was slowing down of the picture taking process and increasing signals were incorporated at the Moscow television center to reduce distortion as experienced in transmission.

Bregman said both television and audio-visual communications worked effectively and that for the first time a duplex system was used on short-distance flights. Flown was on board the ships to enable the cosmonauts to receive upward audio signals from earth while simultaneously transmitting. The Soviet network of audio-visual communication systems on earth was enlarged "considerably" which provided improved quality and increased the distance of transmission, Bregman said. Communications were established between the two ships over the visibility range of several thousand kilometers.

When a cosmonaut left his seat, radio communications was restored by an arrangement of microphones and loud speakers in the cabin so as to provide a uniform acoustic field.

Douglas GEM

San Marcos, Calif.—Douglas Aircraft Co. expects its first manned space shuttle mission (GEM) within the next few weeks. The company is believed to be interested in the space cargo potential of GEM vehicles. The two-man vehicle is expected to spend a week orbiting at 30 to 180 M. Tests will be conducted on California's inland Salton Sea.

Early engineering work on a surface-to-orbit vehicle was carried out by Douglas under a subcontract from the Marine Administration of the U. S. Dept. of Commerce. Douglas also has provided some a computer-aided development program for the vehicle, which is designed to deliver two persons equipped with life.

Belovsky said he endorsed telecommunication flights immediately but said he could not call his endorsement good or confident. Belovsky said an orbital mission he entered the flight in flight, completed different medical tests and observations, observed the earth, navigation and time, took some scientific measurements, picture film of the horizon, down cover, main and communications, worked with equipment on board the ship, carried out radio contacts with earth and with Vosk 6 spacecraft, floated freely in the ship on occasion, ate, rested and slept. He said the spaceport was executed easily and following operation was carried out without incident or was not as serious as it seemed.

He said four times daily had an excellent appetite and had no sleep soundly and on the first day he fell asleep almost at once. Belovsky said that in addition to exercises carried out by previous cosmonauts, he carried out "power" exercises with elastic devices, like translated as a rubber band, he used to make exercises, he helped to maintain his weight capability during the entire flight.

In flight he also carried out further research of means of audio communication between cosmonauts and between spaceports. Before the flight the ships in the current flight charged in all directions from left to right, heard different televisions, Belovsky said. Nevertheless, telecommunication was stable, he said, adding that when Vosk 6 went into orbit, the two cosmonauts exchanged opinions, discussed their work, and used many things.

Communications was stable, he said, and he performed a particular impression and he said he wanted such mission opportunity. He completed different movements in a four-hour condition, observed earth and sky, and he spent about 90 min. a day out of hours. Belovsky later said in a question and answer session that he experienced

no psychic stress, and that he never reported using any instruments. He said he had no trouble with his eating, his luggage and that the only muscle on board his ship was some first time.

He said that his flight program provided for descent on the 12th orbit, which was delayed. He said he never saw any complicated astronomical objects in a rapid flash. He said Vosk 6 floated without shaking but he avoided making it clear whether he was down by passengers in the spaceport.

In his program speech, Mr. Trenchard said that the quality because he continued to weigh himself, did physical exercises, ate with appetite and slept soundly, and he had no trouble with his and the preferred to push his body into restraining straps while the ship rather than let them float freely.

He said his flight assignment involved operation of various equipment on the cabin, including life-support system and radio communications. She registered all observations in her flight log, as a tape recorder and with a color picture camera. Mrs. Trenchard said that she and other female cosmonauts in training did not want to go to sleep to be controlled automatically at the time and so trained "as full humans" which received flight about transport work and learning to observe aircraft and earth.

She said in training group explains was placed on becoming accustomed to the weightless state and practice that were made in different conditions.

He said the sport many hours training in a simulator.

Miss Trenchard said her mission was to observe the earth, and to spend a day in orbit, she said, and to push her body into restraining straps while the ship rather than let them float freely. She said she had no trouble with her eating, her luggage and that the only muscle on board his ship was some first time.

Miss Trenchard said she and other female cosmonauts in training did not want to go to sleep to be controlled automatically at the time and so trained "as full humans" which received flight about transport work and learning to observe aircraft and earth.

He said the brand he used when she stumbled while rearing after landing.

There was no intention to whether the mission was attempted to whether the cosmonauts were in orbit and he referred to designs, direct in staging of the launch vehicle.

Rocket, Missile Designations Standardized

Washington—Air Force, Navy and Army have issued a common order and guided missile designation directive similar to the one issued by several years ago. The list of 240 modifications of 10 rockets and guided missiles identifies each by its size, designation, its former designation, its popular name and the service using it.

A rocket is defined as a self-propelled vehicle, without attached or remote control guidance, whose trajectory or flight path cannot be altered after launch. A guided missile is defined as a vehicle having attached or remote control guidance, whose path can be controlled after launch. Long-range solid rocket boosters are not included in the list. Taper and accelerometer devices are included and are classified as guided missiles.

A designation is made up of all or part of the following elements: status prefix, a letter indicating that the vehicle is being used for experimentation or not, launch mechanism guidance, a letter denoting the type of launch, equipment used, mission number, a letter designating the vehicle's present mission type number, a letter designating the kind of vehicle, design number designating the vehicle type number, the main design, series number, a letter used to denote major modifications to the vehicle, and manufacturer's code, two letters identifying the prime contractor. A list of 49 manufacturer's designations is included.

MA-9 Pilot Counters Skeptics On Sightings of Small Objects

Los Angeles—Astronaut Gordon Cooper has forcefully insisted his conviction that he did not witness small objects on earth during his 22 orbit flight to Mars.

His reports on sighting objects, a river boat and his wife, a train with smoke rising from it and similar objects (AVF Mar 27, p. 26) had produced some second-sighters and suggestions that those sightings were sightings of small objects. He said he was not at all disturbed by the reports.

"I just thought on what I saw, not what I thought I saw," Cooper said in a press conference here yesterday. A bouquet of which he and fellow astronaut Walter M. Schirra, Jr., received the Astronauts Award from the American Institute of Aeronautics and Astronautics. The doubts as to the ability of the eye to see such small objects from a height of almost 500,000 ft have not affected his thinking.

Astronaut Positive

"I'm not changing my mind one bit," he said and "I know what I saw." He challenged somewhat hostile those who question his reports to "take a flight and see for themselves."

Cooper stated that even his flight he had observed some scientific reports which supported his conviction that he could actually see the items. In his opinion, seeing the earth surface from orbital altitude is "no different than flying at 30,000 to 40,000 ft."

Concerning speculation that some type of biological condition caused Cooper to see objects, he said, Cooper countered that if he were having hallucinations, he doubted that he

would have been able to accurately control the Faith 7 space capsule through the intricate remote controls.

While Cooper did not admit the possibility that his observations were reflected in his extraordinary sense of brightness, after space life scientist reports in the NASA news are meeting reported some instances of sightings and suggestions that those sightings were sightings of small objects. He said he was not at all disturbed by the reports.

Don Flickinger, USAF (MC) (Ret.), a consultant on biomedical, remarked that it was mathematically impossible, according to the laws of optics, for Cooper to have seen the small objects. However, Flickinger still believes Cooper perceived them, perhaps through some other mechanism.

"We think it is possible for a person to see visual signals, which he can then integrate with the visual picture coming into the brain," Flickinger said, adding that some new theories on perception possibly could explain Cooper's sightings.

Many referred towards a new theory of Cooper's sighting to some form of perceptual alteration in Stiller, research chief of various research and analysis, Office of Advanced Research and Technology, National Aeronautics and Space Administration.

"Cooper couldn't have seen what he saw because of the visual angle," Stiller said. "There are no objects in the sky." Flickinger's theory of integration of stored images with actual visual pic-

ture, Deutsch wondered how much of the thought involves using things that don't exist (photographs), and how much is just transfer of stored images to a concrete experience in visual perception.

"We need a great deal of study in the area of perception [in a peripheral context], which involves the eye."

Summing up his view of the sightings, Cooper fairly agreed that while the cosmonauts who had seen USSR cosmonauts got off the ground and that a human could not stand weightlessness for any period of time.

Both astronauts were vocal concerning the latest Soviet space flight, particularly the one by the woman cosmonaut, Valentina Tereshkova. When asked whether he felt that, in view of the Russian accomplishment, the U. S. should send up a man and woman together in a Gemini vehicle, Cooper said U. S. astronauts are included in the best of human sensory equilibrium to carry out the mission.

"We had seen it important to the nation. We want someone who can carry out the mission," he said. Schirra added that in addition to women the Russians had demonstrated that they "could afford the luxury of a passenger along for the ride."

Women Astronauts

A NASA spokesman who attended the press conference said Cooper and Schirra were expressing their personal interest in seeing a woman fly. Mr. Trenchard to participate in the mission. He said NASA had no official opinion on the subject. However, the NASA official referred to the hypothesis of the woman cosmonaut and the risks involved in it and from her space capsule as indicating a lack of a high degree of competence. Miss Trenchard is reported to have been an astronaut par excellence and a certain number of women in training cosmonauts.

Regarding the selection of an American woman astronaut, Cooper said that to date "not one single woman has been selected for the manned steps in the qualification necessary to become an astronaut."

Schirra stated that the role of women in future space programs will have to be integrated. "It is a matter of being some day," he predicted.

In other comments during the conference, Cooper remembered, "We are still planning to beat the Russians to the stars. We are making the steps in space hardware a improving, but further experiments would be welcomed."

In discussing planning for Gemini research, Cooper said that the use of the space station used in two-person training airplanes, with an experienced pilot and a flying, could be used.

DASH Will Be Operational in November

By Larry Woods

Washington—Naval dome airborne control helicopter (DASH) will make its first operational appearance aboard destroyers of the fleet in November. The August flight date for introduction of the DASH will be raised because yesterday's problems caused the 50 aircraft, which GyroCorp Co. of Annapolis produced concurrently with development, to be grounded from only this year to June.

Weather under full load conditions had severely affected the altitude sensing device of the automatic flight control system, according to the loss of several aircraft. A partial fix for several restricted operations of production aircraft. The Navy expects to have the problem solved in time to allow unrestricted operation when the DASH is introduced into the fleet.

President Kennedy watched a DASH demonstration from shipboard during a recent Navy weapons demonstration off the West Coast. The demonstration was a helicopter task force, in which a guided missile cruiser and a destroyer torpedo class enough for the presidential tour to see. It operated on three consecutive days.

As the aircraft DASH program was started, the secretary of defense has approved budgeting for enough aircraft to provide two-plus a backup system—for each of the Navy's 240 destroyers, in addition to development models.

Weapons Delivery

The program was approved primarily because it provides a relatively direct means of attacking conventional and nuclear air-sea warfare targets at a range from surface ships several orders of magnitude greater than other surface capabilities.

This is explained in the relatively low cost of the DASH—\$115,000 each for the aircraft including the guidance system and weapons—and the simplified deployment capability. If a missile is not used, the deployment operation would be complex and expensive, and the control system would be sophisticated. A DASH conversion ship must provide a flat deck on the aft part of the ship and landing a small, light helicopter to launch the first aircraft. In addition, the control system is essentially the same as that used for directing target drone aircraft since early in the 1950s, with the added feature that it is integrated with the ship's combat information center (CIC).

Naval surface ships, including destroyers and destroyer escorts, have shifted

from the conventional depth charge delivery to the use of "hedgehogs," which can be fired out about 200 yd, and now are getting the three surface-to-surface missile. But even before it is too late to merge to take advantage of ground day situation might.

DASH is intended to take advantage of its speed—60 kt—and later have a 10-to-20-minute up to 30 min air time in house ship.

DASH has automated several Navy operations, especially those aerial actions which believe that drone operations from destroyers in high air states is impractical. But at the same time there are several systems about operating manned helicopters from destroyers.

The Navy is firmly committed to something almost all of its destroyers, including those in storage, to the DASH system. Many are already converted and are writing operational status of the aircraft.

DASH-1 Operations

In operation, the DASH-1 is wheeled from its hangar and tied down on deck with a hold-down cable, which has a quick-release mechanism operated by the controller. Two overhead cables are connected to the aircraft. One vents the engine and the other acts as the gun-scope for the automatic flight evaluation system and provides other preflight checks for the weapons. The 100 yd. long T-200 on gun-scope for the launch is used during launch, so launching can be accomplished in about 2 min.

RAAF Briefings

London—Royal Air Force (RAF) personnel, headed by Air Marshal Sir Gordon Hewitt, was in England last week for a series of presentations on the British Aircraft Corp. T-200-2 helicopter and its performance. They saw an advance stage of construction and discussed the future of the aircraft.

At a state-of-the-art presentation, north-west 3000 miles from England, the RAF's Canberra jet bomber. For members of the T-200-2, the aircraft made its debut in a one-off test of the aircraft's performance. The aircraft made 4 of the previous week in France. The main is scheduled to leave England this week for the U.S., where it will report the NATO T-200-2. It is tested within 100 yd for 35 to 50 miles, and the latter negotiations for future orders. Construction for the latest version is in the French Foreign Ministry, the British Royal Air Force and the Canadian C-141.

The lateral and landing controller has a station at deck level on one side of the ship at the hangar. It is able to control the collective pitch in setting the altitude. The pitch stick, provides control over downwind, pitch and roll. Heading is also controlled by setting a dial.

On takeoff, an auto timing time clock to No. 6-13 in 20 ft, switches the controller's pitch stick power and sets a higher altitude, which again is a collective pitch on the rotor. Then he releases the hold-down cable and the aircraft climbs. At the predetermined altitude, the aircraft lands off and is guided roughly on a landing toward its target by the deck controller.

Control Change

In the meantime, another controller at CIC has observed the helicopter on his radar scope. He sets his dial to confirm with the flight speed, heading and altitude. On signal, control is shifted from the deck control to CIC.

The CIC controller operates from a third perspective, scope that follows the drone by color and indicates the target information received as determined by radar. He controls the drone's course, speed, altitude and target. When the target and drone position coincide, and the target has been identified as an enemy submarine, the CIC controller initiates the attack and release system, dropping the torpedo on its target. Then, he returns the drone to the vicinity of the ship.

At this point the deck controller takes over and lands the aircraft. This is possible in an urban area to No. 1-10 ft in 10 min. It is working on a system for controlling heading in sea states up to No. 3. In this area, the aircraft would be brought over the deck at about 10 ft. It would then rest on a cable that would be attached to one of the deck.

This cable would be used as part of a scoring system that directs the aircraft's flight in loop over the landing area. The aircraft is then released by a cable that is attached to the deck. The aircraft is then released by a cable that is attached to the deck.

When the helicopter is about 2 ft above the deck, an automatic detent on the cable engages a deck lifting and returns the aircraft into coast again. Then the aircraft is landed.

This landing system will permit the whole DASH system to operate in sea states up to No. 3. It is a very simple system. In sea states No. 4 or above, submarines are generally ineffective. These states are typical of hurricanes

and typhoons and some other details away in the North Atlantic and North Pacific.

In 1961, two years after the DASH program first got under way, GyroCorp had the first test on a new training program. Technical manuals were written and used were issued in a maintenance of the program, and the aircraft. Officers were trained in various duties.

Now the Navy has entered the task at two fleet introduction sites (FIS). One FIS is located at San Clemente Island off the California coast, west of San Diego. Another is located at Fleet Neck, Va. Responsibility for the training is the hands of Utility Squadron Three (U-11) on the West Coast, and Utility Squadron Six (U-16) on the East Coast. U-13 and U-14 were changed because, in part of the new aircraft acquisition, three duties are added: training and operation of the aircraft as a fleet support or target.

Overall program control for the Navy is vested in the sub-variant warfare division headed by Rear Adm. J. N. Shaffer, who reports to the deputy chief of naval operations for fleet operations and readiness. Capt. Carl A. Sander is assistant for the program.

Program management is located in the Bureau of Naval Weapons under

Rear Adm. Allen M. Shoen, assistant chief for program management. The program officer, Capt. J. C. Henderson, is located in the destroyer for under sea warfare program.

Funding so far has been as follows: Fiscal 1960, \$44 million; Fiscal 1961, \$57 million; Fiscal 1962, \$71 million. This funding is for the complete system. Funds required for Fiscal 1963 are much higher and for the the three years following will level off at a slightly lower figure as production runs simplify and development is completed.

A whole of destroyers fleet personnel has been in preparation of the deployment of the DASH system. The destroyers and destroyer escort Navy represents the first step in the development of the "black ship" system and, because the number of larger ships has been reduced. The conversion of the fleet is threatened due to Admiral's decision to delete the need for its displacement surface force main defense orders for the fleet.

Adm. Shaffer gave an example of how well the DASH is being accepted. When the aircraft has been aboard ship, the crew has had a tendency to fly there two weeks. "I've had to remind them that their next model would be plus, well, I said."

European-Built F-104G Makes Low Pass at Paris Show

Video demonstrations have been shown showing the wingtips of a European-built Lockheed F104G Superfighter during a low-level, high-speed demonstration at the Paris Air Show in Reims. The aircraft was piloted by the Belgian Air Force (BAF) and was part of the European consortium building F-104G. The aircraft was a member of the F-104G, including other aircraft, was one of the outstanding flight demonstrations on the day of the Paris Show.



Studies of Aerospace Plane Are Awarded

Washington—Air Force has selected three teams to receive development plans, award contracts covering system design for an aerospace plane concept which contains a manned, winged, earth-to-space vehicle propelled by air-breathing and rocket engines (AWC 31, 1962, p. 18).

General Dynamics/Aerovironics, North American Aviation's Los Angeles Div., and the Douglas Aircraft Co. each will receive contracts for \$500,000 from the Air Force Aeronautics Research Division at Wright-Patterson AFB.

Independent studies have been made by the Air Force Aeronautics Research Division at Wright-Patterson AFB. The Boeing Co. and Convair Aeronautics Co. have been awarded contracts for \$500,000 each for development of aerospace concepts, and \$10 million has been requested for fiscal 1964.

The original aerospace plane concept was designed to be a manned, winged, earth-to-space vehicle. The aircraft would be launched by a rocket, and its propulsion system would be a combination of a rocket and a liquid-fueled engine. The aircraft would be launched by a rocket, and its propulsion system would be a combination of a rocket and a liquid-fueled engine.

Experts Rebut McNamara: Back Boeing's Use of Titanium for F-111

By George C. Wilson

Washington—Senate Permanent Subcommittee on Governmental Operations, headed by Sen. Robert S. McNamara (R-Calif.) (D-Calif.) decried last week by taking testimony from witnesses who challenged claims that Boeing's proposed use of titanium in the aircraft was an error.

McNamara reversed USAF—Navy aircraft selection boards which recommended Boeing for the \$4.5 billion F-111 fighter over Lockheed's F-105 and USAF Secretary Eugene N. Zostert provided these claims of Critical Dynamics—Greenville for the contract partly on grounds that Boeing's planned use of titanium might lead to technical problems.

In a 32-page statement filed with the subcommittee May 17 (AW May 25, p. 51), McNamara said one of those major problems the board comprised the development of the Boeing design "was its extensive use of titanium in its wing carry-through structure."

Zachary, in his Nov. 21, 1962, memorandum on the decision, agreed also by Navy Secretary Fred Smith and approved by McNamara, and use of one of the examples of "excessive operations in the Boeing program" was "the use of titanium in structural members." McNamara also said McNamara (D-Ark) obtained this point-to-point rebuttal to those arguments in a hearing June 25, which marked the end of his "attempt to do his job as chairman of the board" by questioning McNamara, Deputy Defense Secretary Russell L. Gibson, Zostert and Kelly.

Wing structure. George Gerard, consulting engineer who served on the Defense Dept.'s titanium study, refuted McNamara's claim that "from an airframe analysis, Boeing made a correct choice of materials in the wing carry-through structure." He said steel would be 25% heavier and aluminum alloy 80% heavier in the structure required to withstand the stress that would be applied to the wing. McNamara said, "in that there is no significant risk in the use of titanium in this application. It has the distinct advantage that it enables the lighter fighter. In fact, I would question the use of any other material in the application." Walter Hyler of the Boeing Material Research Center said he agreed that Boeing proposed a "reasonable application" of titanium.

Ward Middle, manager of technical

services for the Titanium Metals Corp. of America, and "The Boeing design is a simplification, the strength, the use with which they were getting the metal, was within the capability of the metal in its own right. It is correct no material risk."

Fatigue, temperature. Gerard said the best way to assess about fatigue in an aircraft is by comparing tests "on the complete airplane." He added, however, that every titanium material and its use in the aircraft is subject to the choices of manufacturing in type problems and might also be better.

Titanium did not pose temperature problems in Boeing planned to use it, he said.

Middle and the titanium also Boeing had planned to use under \$600,000 of testing at Battelle. "We have reviewed the Boeing design component with respect to fatigue and in the use of our Battelle study, in our judgment, Boeing made a very sound use of titanium in the wing carry-through."

Sen. Zostert's statement also for Budget panel Chief of the House, Oregon, said from his knowledge of the titanium alloy Boeing intended to use "there does not seem to be any risk, associated with Boeing in this application."

Titanium advantages. Sen. McNamara, Boeing's defense design section chief for the F-111, said titanium's thickness of wing carry-through plates would have been a major factor in the decision to use it in the final point also. However, the titanium alloy would have been a low-risk Boeing officials said that 3-in. was not an unusual thickness. They said, however, that the carry-through structure would have a strength of 100,000 psi.

Previous experience. Boeing officials said titanium was not contemplated for use in the use of the F-111's wing carry-through, claiming that steel with Teflon in the bearing was intended.

Aluminum-titanium alloys. Robert E. Wilson, Boeing's chief of structures, and the fatigue problems had been thoroughly analyzed and that the alloys were designed in accordance with engineering techniques that are widely accepted.

USAF instructions. Sen. McNamara said an Air Force F-111 task statement which said "special consideration shall be given to the use of titanium with a view toward reducing weight of the aircraft" is the first of the Air Force dated Aug. 9, 1962, and titanium "is not at all viable for application in heavy section areas because of lack of data on titanium alloys in heavy sections." Sen. McNamara said that he did not consider 1-in. thickness a heavy section.

New Digest

New Zealand cabinet has approved funds for immediate purchase of three Lockheed C-130E transports for the Royal New Zealand Air Force. The cabinet also approved acquisition of six anti-aircraft aircraft in its five-year defense program. While in Lockheed's Minerals plan regarding for the C-130E, a 14-man air force team will look at Lockheed's plan for a proposed anti-aircraft version of the C-130. Lockheed's present ASW aircraft is the P-3A Orion built by Lockheed-California.

Boeing Helicopters Co. last week was awarded a \$54,000,315 contract to supply 100 UH-1B and 100 UH-1C helicopters, and helicopters for the Army. This contract includes an order, maintenance, and updates a 32-500-hour letter contract awarded last November. Total value of the contract for 100 aircraft is \$79,393,165. Included in the new order are 100 UH-1B for the Royal New Zealand Air Force and three for the Royal Canadian Air Force under the military assistance program.

National Aeronautics and Space Administration has notified Congress that it will use \$8.2 million in research and development funds appropriated in Fiscal 1963 for research, development and testing of launch pad, and launch vehicle programs for modifications of launch pad 308 at Cape Canaveral, Fla. The Air Force is the contractor and will be paid \$18.5 million, but it now estimates at \$24.9 million.

Avco Corp.'s Research and Advanced Development Div. has ordered a \$121,518 contract from NASA's Lewis Research Center for development of a 2.5-lb. aluminum engine.

J. C. (Cliff) Gerrett, 51, founder of the Gerrett Corp., died in Beverly Hills, Calif., June 11. At the time of his death, Gerrett was serving as president and chairman of the board.

Boeing Netherlands Navy has ordered three Sea King helicopters to be delivered to the Royal Netherlands Navy. Each ship will be equipped with two Sea King launches.

Douglas Campbell, co-president and general manager of Pan American-Gulf Airways since 1945, has retired after 24 years of service with the airline.

Thomas G. Rindling, vice president and general counsel of McDonnell Aircraft Corp., was killed last week in a helicopter crash on a test track in St. Louis County.

AIR TRANSPORT

Northeast Retention of Aircraft Proposed

Sen. Kennedy, Massachusetts governor seek to save New England service amid threats of repossession.

By James R. Ashlock

New York—Hughes Tool Co. was offering proposals last week to General Dynamics Corp. and Vickers-Armstrongs, Ltd., in which Northeast Airlines could continue at least temporary use of its Conquest 800 and Viscount aircraft.

Both General Dynamics and Vickers had threatened to repossess Northeast's six Conquest 800s and nine Viscounts unless overdue payments were made (AW June 24, p. 40). Approximately \$4.8 million is owed on the Conquests and \$7 million on the Viscounts.

Hughes Tool's initial proposal suggested that in view of Northeast's financial condition, consideration be given to writing off the debt in exchange for eventual return of the aircraft. Until this was accepted, payments by the end of September, less payments would be made on a scale approximating half the normal monthly payments offered for in the original lease and purchase contracts, according to the proposal.

Such a move would allow Hughes Tool time to re-organize Northeast with substantial assets. The tool company at one time owned five 500s, two of which are in storage at Detroit, Mich. The two others are in Boston, where they are used by Northeast on its Florida routes during the winter.

General Electric, which was leasing the CG805 engines to Northeast for the 500s, also has said the airline to retain the engines with the airlines to General Dynamics. The company and Northeast a \$2.35 million in debt for an lease payments, including \$100,000 for the lease of the engines in 1963 for spare parts and maintenance. Lease, which was signed in June, 1960, was modified by General Electric in June 1961.

Hughes Tool's offer came amid growing concern in New England political circles over the threatened loss of Northeast's service to that area. Gov. Edward Brooke of Massachusetts called a meeting last week in Boston to discuss the problem. Present at the meeting was Sen. Edward M. Kennedy, brother of the President, who urged those present to do everything possible to retain Northeast's air service. Kennedy's concerns over Northeast stress largely on Boston being the center's home base, and the airline's slogan at the time, "the airline company with 731 men devoted for Massachusetts."

Kennedy's presence reportedly was a factor in cooling down the two aircraft lease negotiations.

He also asked whether it would not be better to let Northeast keep the aircraft for a while and try to effect a recovery rather than wipe out the airline's assets of production assets. It was decided that the participants in the meeting would study the problem through the week, then reconvene before Brooks at 4 p.m. last Friday to present two proposals.

General Dynamics' acquisition of the Hughes Tool plan, which it was announced for some time ago, to write off the debt on the lease of the Conquests and Viscounts, in part payment of the debt. The company has the option to have General Dynamics purchase the stock at \$50 per share.

has had several plans to merge, a plan which was later canceled.

The aircraft were part of an order for 10 Conquests placed by Hughes Tool, which planned to lease them to TWA. However, financial complications arose with Hughes Tool that not only delayed delivery of the 500s, but actually suspended their production.

Hughes Tool later proposed that use of the completed aircraft be leased to Northeast by General Dynamics, and that area was accepted. Hughes Tool eventually purchased the remaining 24, delivering 10 to TWA and keeping four.

Major success at its commercial project resulted in General Dynamics having to write off \$28.5 million in payments due for the 100 Conquests. The corporation's financial condition was not as good when it purchased the Mutual Shares Corp. in 1960 from the Crown family, giving them of convertible preferred stock, in part of the purchase.

The Crown family then bought the Beverly Hilton Hotel in Los Angeles and sold 100,000 shares of the General Dynamics stock, with approximately \$25 million, in part payment of the debt.

General Dynamics' decision to sell the stock for the \$20 million value of the aircraft. A sale of the stock and interest payments was willing to accept such a deal.

However, General Dynamics had to guarantee the lease before the leasing of the aircraft.

Pan Am Seeks \$160 Transatlantic Fare

Washington—Pan American World Airways has filed amendments plans to reduce transatlantic air fares by 10% to \$160 and California Airlines to \$180, subject to approval of the Civil Aeronautics Board.

The new rates, in extension of the airline's present fare plan since between New York and Paris-Rome, would cut 1963 from the fare increase last year. The Atlantic to London and 314 from the California fare level. These cuts would be possible on a year-around, daily flight schedule, covering the airline's reports of highest aircraft use being used in combination with class and economy service. Such and other fringe benefits would be eliminated.

Approval by CAB, the new annual will be issued to HWA in New York. The transatlantic service would not be started until April, 1964. Despite the delay, the HWA route is believed to be a factor in the airline's decision to cut the transatlantic fares.

committee would hand over the money. In addition, a separate organization, Northeast Leasing Corp. (NLC), was established to administer the lease and to hold the title on the aircraft. NLC was a subsidiary of American Financial Services, Inc.

Approximately two months after this agreement was completed, Northeast began defaulting on its lease payments. Consequently, General Dynamics, as guarantor of the lease, had to begin paying NLC not only the principal but also the interest on the lease. The distress it represents the \$500 cost when General Dynamics' payments on Northeast's overdue account had reached \$4.4 million.

Following interest and open carry, General Dynamics' earlier on the North east account is probably well above the \$4.4 million in defaulted payments.

General Dynamics has also regional ties to the \$500 by leasing the aircraft from NLC as an end-user plan. This was necessary before General Dynamics could be close to the aircraft and more for representation.

General Electric's loss of the contract to Northeast caused no visible

organization such as NLC, so no lease payments were received from General Electric in lieu of Northeast's default. Sources close to the matter feel it is unlikely that other General Dynamics or Vickers will actually attach any risk to a lease on Northeast has a chance of recovery. Unless carry buyers were involved, neither acquisition would stand to receive or receive only very quickly with the airplane in their own, rather than Northeast's, possession.

Hughes Tool's buying not its interest to hold off the manufacturer, says they feel that sublease payments are no more likely to come from Hughes than from Northeast's financial situation. Hughes Tool, executive vice president of Hughes Tool, says that Hughes will not sell its lease to Northeast, but it will be of little help.

Northeast's last, and perhaps only, hope is in raising permanent contributions from the fleet's current owners. With this last hope, the company stands a reasonably good chance of merger with a larger, more financially sound airline.

Also, the chairman of the Civil Aeronautics Board, who said that it is in favor of Northeast's continuance in

the Florida market should be reached within 30 days. While Northeast wants permanent certification, most sources feel that the FAA will not give a favorable chance of being approved of the temporary certificate.

Meanwhile, both Northeast and Hughes Tool are conferring either on a part of a merger pact. David W. Jacobs, Northeast's president, met recently with Charles C. Tillinghast, Jr., head of TWA, and there is speculation that TWA will be the most likely merger partner.

However, any merger agreement would unquestionably be conditional on Northeast receiving a permanent Florida route certificate and transfer of the Northeast's fleet to Hughes Tool's service, to be a local service route.

Acquisition of a north-west route would benefit TWA, largely because it would extend one of the airline's current routes. With this route, the company stands a reasonably good chance of merger with a larger, more financially sound airline.

Explanation of Merger Rejection Awaited

Washington — Civil Aeronautics Board's 3:2 rejection of the American Airlines-Eastern Air Lines merger has left the airline industry in a state of uncertainty created by the Board's lack of a detailed explanation of its action.

In general, both the applicants for the merger and those who opposed it believe that the case is a very complicated one that provided the proper subject for prolonged litigation, long before the Board took its vote.

What the decision portends for future merger proposals is not clear. Some—and not a few—believe the Board has not issued a detailed, formal order explaining its decision, and appears to be divided in its vote.

The one unanimous opinion of the court is that the decision is not the subject of the Department's recent vote of Chairman Alan S. Boyd and Members C. Joseph Murtha and Robert M. Maguire, which the Kennedy Administration's determination to block any concentration of power in the airline industry. Other than the protection, the vote could be for the merger, since from the Board's two dissenting Republicans members, Chas. Gurney and Whitby Griffith.

Prodded by Eastern, the Board made the announcement in a "tentative" press-release decision, explaining that merger of the interested parties involved was subject to White House approval, and that a final, detailed

order on the rejection of the domestic route merger would be issued by CAB at a later date. Last week, American Airlines and Eastern filed appeals of the entire merger application, before the Board.

The action by American challenges the decision, but also procedural matters of the case.

Speakers for Eastern, which had criticized a case aimed at closing of financial accounts (AW May 21, p. 37), expressed disappointment over the CAB decision, but added that the company is encouraged to get answers from the decision over the last few years in discussing many factors beyond its control.

Eastern President Malcolm McLean later complained that the government must clarify the exact terms of its 11-point transportation reform grade law, formulated by a special White House-appointed committee established more than a year ago (AW Apr. 4, 1962, p. 41). Recommendations of the committee were sent to the President by March 10.

However, when the committee began to form its guidelines last year, the CAB stated that the final recommendations would not be applied to the American-Eastern merger case, which was then in its only preliminary staff. Board procedures confirmed this statement last week.

McLean said that the entire law

no further merger plan, and will go ahead alone. "Over those there may be some merged interests." Arrangements for the withdrawal of the merger from the Board's consideration, and Eastern will seek new capital to purchase a fleet of 60 Boeing 727s at a total cost of \$500 million, he said. The Board's decision, he said, is a setback for the merger, but he said that he will continue to work for the merger.

The Board's handling of the merger during a press release, he said, is a setback for the merger, but he said that he will continue to work for the merger.

Eastern's merger plan to both the CAB and White House triggered the press release decision, but the Board is expected to make a decision on the merger in the next few months. The Board's decision is a setback for the merger, but he said that he will continue to work for the merger.

If the decision before the system was concerned over the possibility that the size of a combined American-Eastern carrier would create a monopoly, it was not a concern. The Board, the Dept. of Justice and a CAB executive, the Board has succeeded in thwarting airline hopes of any further

major application of similar size. It also shows the impression that merger application between a large and a small or two medium airlines would have a reasonable chance of being approved.

While the Board's decision that it has made an "independent" judgment on the merger, its action is being interpreted as a rubber-stamp approval by the President—expressed through the CAB—of the objection against the merger raised by Attorney General Robert Kennedy (AW Apr. 4, p. 45).

In addition, several of the major points used by Eastern's Ralph Winter to his recommended rejection of the merger (AW Dec. 1, p. 10), which those major points used by the Inter-transport Commission on Transport Management, which is a very strong

• Committee urged that the problem of increasing competition be considered in an merger proposal, and that the merger would result in reduced service to users. Winter stated that approval would "leave" the competitive balance among the airlines, and that the competitive balance would be lost.

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Kennedy Asks for Supplemental Funds to Spur U.S. SST Program

Washington—President Kennedy's request for a \$60 million supplemental appropriation for the U.S. supersonic transport development, followed closely a strong plea by the Federal Aviation Agency for approval of its \$100 million program before the House Interstate and Foreign Commerce Committee (AW June 24, p. 39).

Funds requested by the President would be in addition to the \$30 million already appropriated for the program, and would be used to speed the development of a supersonic transport, and would finance the initial design stages of the program next year.

FAA Administrator R. E. Hill, in a letter to the President, urged the need to build an aircraft capable of the Mach 2.2 British/French Concorde, and gave a recent report on the problem to be reported.

At the same time, the study was made between the Administration's figures on the cost of developing a supersonic transport and those of a special FAA advisory group in pointing out the importance of the study.

The report also noted that the U.S. should build a supersonic transport and begin development of a Mach 3 transport—some around 1964.

Hill's request, this concept is not recommended to the Administration on grounds that the U.S. (and also a supersonic transport capable of Mach 2.2) would be a major step toward the development of the aircraft.

Group project: "The U.S. supersonic transport program is a major step toward the development of the aircraft." Hill's request, this concept is not recommended to the Administration on grounds that the U.S. (and also a supersonic transport capable of Mach 2.2) would be a major step toward the development of the aircraft.

Some have said that an "unacceptable" philosophy with the supersonic transport program is that the U.S. should be a major step toward the development of the aircraft. Hill's request, this concept is not recommended to the Administration on grounds that the U.S. (and also a supersonic transport capable of Mach 2.2) would be a major step toward the development of the aircraft.

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Heliport Support

New York—Herald news in the U.S. of the new New York Building has not supporting the plan for scheduled helicopter operations from a nearby heliport on the Hudson.

The news' article contains other information on other building issues (AW May 27, p. 56) which included that the heliport would have associated costs and safety concerns.

Those involved in the heliport are members of the Grand Central Bell Group. They said the heliport would be a major step toward the development of the aircraft.

Pan Am to Seek IATA Freight Rate Trials for All-Jet Service

New York-Pan American World Airways will encourage the International Air Transport Association to permit new freight rate experiments in quest of lower rates simulated possible for all-jet cargo operations.

Using three Boeing 720-120C freighters, Pan American recently inaugurated, according to the first all-jet cargo service on both the Atlantic and Pacific, with its flights meant to Europe and then to Japan.

Harold Gribben, vice president of cargo sales, said that an eventual reduction of 10-15% over existing freight rates would perhaps be justified in view of the jet's speed and lower ton-mile operating cost.

"It is here we started experimenting with new rate advances, such as bonuses for bulk shippers," Gribben said.

Pan American has five new 320Cs scheduled for delivery next year, and long-range plans call for eventual conversion of the world's jet freighter service. Of the three new 320Cs, one is being allocated between cargo and passenger use.

The aircraft being used for both passenger and cargo service was the 320C delivered to Pan American. It was equipped with DC-7F turboprops on the Pacific and used for proving new rates to the actual all-jet cargo aircraft that Alouette American Airlines and Transworldair operated. The latter has not been installed in it yet, so cargo is being hand-loaded.

Pre-Inaugural Trip

Gribben and three to five pre-inaugural road trip to Tokyo, the aircraft was first to its rate trial, including a high proportion of bulk. The trial was in an encouraging indication of the speed the jet will have to shippers, as well as how can be transferred to other air.

Approximately 4 hr are required to convert the aircraft from cargo to passenger configuration. However, it will be obtained to Boeing this fall for installation of the preferred loading system, and will be used exclusively for cargo service thereafter.

Gribben said that the attraction of Midway Air Transport Service business was not a significant factor in Pan America's decision to buy jet freighters. Less than 1% of the airline's transatlantic cargo volume comes from MATS, he said, and only about 3% of its transpacific coverage is within.

Bulk shipments, though with a high weight per cubic foot, have become more important with the advent of the jet freighter. Pan American cargo will

also and because of the 320C's 87,100 lb lift capacity, jet operation saves shiploads reduced to a small packaging is possible.

A shipper could haul a 50,000 lb load of bulk if it consisted of bulk in bulk used in use, as plans to even it, a spokesman said.

Consequently, Gribben faces some uncertainty, such as a discount, for high weight density shippers. The latter would apply, he said, for frequent shipper of products with a standard weight and cube density.

Important factor with jet is maximum utilization of space. Pan American has made extensive studies of cargo products, so it knows the approximate cube displacement of most commodities.

Space Booking

Look at it, he said, cargo space in the jet freighter will be a certain weight per cubic foot, a good margin of safety, just in case the cube requirement of the load proven greater than anticipated.

"This doesn't mean the flight will go out with several thousand pounds of unused capacity. If the load doesn't take up the space we've left for margin," a spokesman said. "There's almost always enough unloaded freight on hand to top-off the load."

Look at capacity is the limit of the jet freighter operator's worries at present. The 320C will break even with approximately a 50% load factor, and cargo authorities agree that shippers can load up to 100% in bulk freight more than half full until there is further market expansion.

Pan America's initial New York-Los Angeles flight with the freighter carried 48,000 lb of electrical, surgical, home build and automobile items. One of the first San Francisco-Tokyo flights, via

Hawaii, carried 57,200 lb of electrical, medical and clothing items.

As a hedge against excess capacity, Pan American is contracting space in its freighter to other airlines. Japan Air Lines has taken two policy agreements, 10,000 lb, on each flight since the Pacific interest in a similar agreement has been expressed by some European carriers. Pan American is paid for that space whether the contracting airline ships it or not.

The three recent jets are being used primarily on a New York-Los Angeles-Tokyo route, and about the Pacific from San Francisco to Tokyo via the jet freighter. The latter is going to Japan. Now only Tokyo-San Francisco service is offered, with the 320C capable of carrying a 60,000 lb payload on this routing.

DC-7F Connections

Pan American also is running the aircraft into Kansas, with DC-7F connections to Kansas, and the Middle East. Two flights a week also serve Chicago and Detroit. As jet freighter fleet expands, Pan American expects to offer also jet polar service from the East Coast to Europe, as well as from Chicago to London.

"One thing we have to express open shippers," Gribben said, "is that today a manufacturer in Chicago can be just as competitive in Paris, using air freight, as it can in Frankfurt shipping to Paris by surface mail."

Pan American is based in London with airframe deliveries in late eight deliveries. However, since the aircraft are based in the U.S., it is a holding down its fleet load to carry air service in payload, thus reducing at Kansas. This way, it is a question from London to Los Angeles in 2 1/2 hr.

Gribben says there is an important balance of freight exchange between the U.S. and Europe with domestic servicing covers the American position.

The next 10 years will see a rapid increase in foreign demand for heavy high-volume items that can best be distributed by air, he added.

"Before long, there's the disposable income, that which is used for items of personal requirement will be 65% in Europe in the next decade," Gribben said. In Japan it will double, and in the United States it will not reach \$208 billion.

"This means that in just 10 years, the disposable income available in these three areas alone will provide \$350 billion more for spending in the consumer market."

As a result, Gribben said, worldwide demand will increase substantially for luxury items that have a high value per pound. Such products contribute a prime reason for an air cargo.

Major U.S. Airports—Part 3:

Oakland Pushes for More Airline Service

By Robert H. Cook

Oakland—Metropolitan Oakland International Airport has everything the passengers want, with the exception of one vital ingredient—sufficient flight schedules.

Since its dedication last September, the 520 million dollar bay recently built an airline "ghost town" contained in the "honey hole" activity of San Francisco International Airport across the bay (AW 10/14 p. 3).

Intensified efforts already have been made to make the airport more accessible for both the construction of the new airport—access to Oakland was given—and the airport's situation level traffic over the past eight months. Current plans for the airport's future, however, are the lack of flight schedules at Oakland, encouraged Oakland's airport construction and give

communities that adequate flight schedules would be offered. These efforts began during the past summer, however, even before the formal airline contracting conference at the new airport.

As a direct result, the airport trustees' concept, a only third of the originally planned use. Oakland's trustees have been concerned over the lack of action on this \$10 million general obligation bonds voted for the airport, which put 43 airlines and its own revenues into the project.

Traffic Figures

Oakland's reason for building the new airport is being demonstrated by quick survey of traffic and revenue figures since 1960. In the same year that San Francisco was putting more a \$10 million surplus from its airport operation, Oakland barely managed a \$170,000 operating profit.

In 1961 1962 the profit dropped to only \$16,000.

Passenger handling is a comparison of volume since 1961 with 1962, increased only 30,000 to a total of 313,756. Supplemental volume passengers accounted for much less this total. In 1957 Oakland had 12,471 departures compared with 8,815 in 1961.

Oakland has been left with a high percentage of low-volume, low-mileage business from general aviation, local private and supplemental carriers, while San Francisco reap the benefit of a highly profitable, high-volume, high-mileage business. Nearly 75% of San Francisco's traffic falls in this category.

This situation is now in the process of being overhauled. However, the effects of passenger and population

with the airport by Oakland and diplomatic activities by the Civil Aeronautics Board.

Those World Airlines has started direct Boeing 740 flights to Chicago, Oakland, New York and Los Angeles. The month and United Air Lines is offering Boeing 720B service to Los Angeles and Douglas DC-8 flights to Portland and Seattle. Western Air Lines has added two daily Lockheed Electra flights to Los Angeles.

No flights have been removed from San Francisco, the volume complaints.

Further growth of the Oakland airport will depend upon the extent that East Bay residents patronize the new service. American Airlines, which provides Douglas DC-7 flights to Phoenix, Tucson and Dallas—can put on Boeing 720s into Oakland next year. National and Delta, which serve the bay area as part of the western metropolitan traffic, also are watching the traffic potential of Oakland.

CAB can clear much of the credit for the new pattern of airport service, Oakland officials concede, since only attempts at general regulation with airline loads failed. After a campaign by Oakland and the five counties looking up the East Bay area, an increase of service was indicated by CAB last January. The CAB permitted the night airline scheduled to serve the bay to conduct just schedule airport service with the East Bay airports.

With the aid of Col. John W. Dwyer, director of county and congressional relations for the board, the present pattern of new service was developed after four months of discussion. The decision of service over and parking was dropped.

On the basis of past and projected population growth, Oakland feels it owes a total passenger service with about 550 million per year. The bay is understood that air travelers tend to leave for purposes from their homes.

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In 1961 the population census stood at 3.5 million for the East Bay counties of Solano, Contra Costa and Alameda, which includes the cities of Oak-

land and San Francisco. Past population trends, and projections were used to adjust the figures. Among them was a projection in leading cities from the previous that for 1950 to 11 each per 1,000 in 10 years leading weight with a reduction to only 3 each when the number with 11 million.

Oakland's reply to the county's reluctance to accept the new airport has been that a high percentage of the East Bay county residents of Alameda, Contra Costa, Napa and Solano, have been forced to commute, traveling further to use San Francisco International for the simple reason that airlines did not offer adequate schedules at Oakland.

Survey Results

To prove this point, an independent survey of passengers departing from both Oakland and San Francisco was made during the first week of April 1962. It showed that the East Bay region generated more than 25% of the engineering traffic in the entire bay area, at a total passenger volume with about 550 million per year. The bay is understood that air travelers tend to leave for purposes from their homes.

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CONCRETE CANOPY DESIGN of the 100-ft long building at Metropolitan Oakland International Airport attracts over sidewalk and parking lots. Clotted over lanes could longer in better coordinated system.

JET AGE TRAFFIC CONTROL

Selenia ATCR-2 23 cm. radar for terminal areas and upper air route control



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land) and Alameda, compared with 1.5 million in the West Bay area. With this concentration quickly equal in size, Oakland airport handles at least one third of the total Bay area airline traffic. In 1980 it is anticipated that San Francisco, which handles more than 5 million passengers will reach 6 million and Oakland will serve 4 million passengers.

The Oakland facility now has only one passenger-loading bridge which the Federal Aviation Agency estimates will reach the 1 million passenger interurban point within eight years. Design of the terminal complex provides for enlargement of the existing and terminal building plus addition of three bridges.

The inevitable of development could be delayed for several years, however, unless Oakland is successful in securing and holding its share of the bay area traffic.

To accomplish this goal, Oakland has embarked on an aggressive promotional campaign designed to inform East Bay residents of the advantages of using the new facility. To date, 519,906 has been contacted for media, television and newspaper advertising.

Prospective users are told of the savings in ground travel time from their homes and advantages of travel times on the air flight itself. The airport management has even installed a special telephone information center which gives detailed answers to all questions about the new flight schedule.

Patient promotion also includes subsidizing of a limousine service to provide all passengers with a ground transportation ride comparable to that at San Francisco International.

As a double facility, Westcoast Oakland International has all the land-water desired by an airline and all the amenities sought by passengers. In 1969 it, currently is equipped with high-speed terminals, constant lighting and an instrument landing system. Overviews of 300 ft. are provided at each end. Premium airport radio and noise surveillance radio is also available. The old 90-acre terminal complex has extensive maintenance facilities connected with the new two to three. New hangars can be added.

A 177-acre land is located on the airport property, and gift shops, a cocktail lounge, a restaurant and parking are available. Walking distance from the ticket counter to the end of the flight is about 300 ft. As an added advantage, San Francisco Helicopter Airways serves the field.

(This is the third of a series on major U.S. airports from the public's point of view. The fourth report, concerning Los Angeles International Airport will appear in a subsequent issue of Aviation Week & Space Technology.)

Airline Traffic—April 1963

	American Airlines (April)	Other Airlines (April)	American Airlines (April)	American Airlines (April)	Total American Airlines (April)	American Airlines (April)	American Airlines (April)	American Airlines (April)
	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)	Domestic Traffic (April)
DOMESTIC TRAFFIC								
American	10,439	199	344,300	18	70,420	4	10,407	98
Boeing	2,144	101	101,481	5	11,440	4	2,144	98
Continental	2,147	103	101,481	5	10,363	4	2,147	98
Delta	2,370	120	203,410	10	20,364	5	2,370	98
Eastern	501	4	411,340	10	44,703	10	501	98
Norfolk	3,419	101	104,307	10	14,617	4	3,419	98
Northeast	1,475	100	14,540	10	7,751	4	1,475	98
Northeast	2,433	100	14,540	10	14,540	10	2,433	98
Trans-World	5,249	100	401,420	10	49,303	10	5,249	98
United	15,280	100	401,420	10	76,440	10	15,280	98
Western	3,113	100	102,115	10	11,745	5	3,113	98
Domestic Traffic Total	61,497	6,000	2,101,140	10	244,300	2	61,497	98
INTERNATIONAL								
American	127	13	10,375	4	5,331	5	127	100
Boeing	372	6	10,375	4	5,422	2	372	98
Continental	167	5	4,376	4	450	1	167	98
Delta	102	2	3,397	6	422	4	102	100
Eastern	915	43	62,418	10	8,732	7	915	98
Norfolk	17	1	302	4	143	1	17	98
Northeast	207	16	41,370	10	7,412	4	207	98
Northeast	209	10	7,548	10	2,327	4	209	98
Trans-World	1,054	100	101,107	10	86,340	10	1,054	98
United	33	5	5,390	10	107	4	33	100
Western	332	17	34,372	10	9,341	7	332	98
Trans-World	1,475	100	14,540	10	13,221	10	1,475	98
United	190	7	42,444	10	3,144	9	190	100
Western	101	7	11,315	4	1,114	2	101	100
International Traffic	14,184	200	107,100	10	130,121	8	14,184	98
LOCAL SERVICE								
Allegiant	278	75	19,916	44	3,491	3	278	98
Boeing	301	43	11,347	40	7,149	7	301	98
Continental	81	10	6,232	40	891	120	81	98
Delta	546	40	11,437	27	1,112	14	546	98
Eastern	303	10	8,340	8	884	16	303	98
McCarb	142	100	10,375	10	3,324	24	142	98
Norfolk	1,014	100	14,540	10	1,222	10	1,014	98
Northeast	844	47	12,446	10	1,237	10	844	98
United	442	43	8,470	30	93	10	442	98
Western	1,014	100	14,540	10	1,237	10	1,014	98
Trans-World	844	48	1,344	24	107	10	844	98
Trans-World	470	16	1,344	10	917	10	470	98
West Coast	470	16	1,344	10	917	10	470	98
Local Service Total	10,000	740	100,000	10	16,116	1	10,000	98
ALLEGANT & HAWAIIAN								
Allegiant	124	4	4,344	21	5,422	4	124	98
Boeing	120	7	10,375	10	77	4	120	98
Continental	107	10	1,008	10	417	3	107	98
Delta	370	4	8,340	10	875	3	370	98
Eastern	32	5	49	10	10	10	32	98
Trans-World	347	7	7,548	10	5,480	4	347	98
Pacific Northwest	112	1	1,119	10	810	10	112	98
Trans-World	32	5	10	10	4	10	32	98
West Coast	39	2	10	10	4	10	39	98
Allegiant & Hawaiian Total	1,744	110	35,156	10	4,400	4	1,744	98
ALLEGANT & HAWAIIAN								
Chicago	29	5	117	4	12	4	29	98
San Antonio	23	14	39	40	44	7	23	98
New York	44	20	410	40	47	10	44	98
Allegiant Total	100	10	1,100	10	100	10	100	98
CHUGO & OTHER								
Allegiant	34	5	117	4	12	4	34	98
Boeing	1,117	2	10,375	10	10,375	10	1,117	98
Continental	104	5	21,339	10	10,375	10	104	98
United	214	5	1,119	10	8,702	10	214	98
Chugo & Other Total	3,311	16	44,739	10	41,812	10	3,311	98
National Total	80,890	6,844	4,140,230	10	221,411	8	80,890	98

Prepared by Air & Ray



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INCREASE IN REVENUE PASSENGER MILES

Domestic system over past six years

	TWA	AMERICAN	UNITED
October, 1962	9.2%	1.5%	1.8%
November, 1962	32.2%	(-0.3%)	1.7%
December, 1962	4.4%	(-0.7%)	4.6%
January, 1963	8.1%	8.9%	6.4%
February, 1963	9.3%	(-1.1%)	3.7%
March, 1963	34.2%	7.0%	4.0%
April, 1963	35.2%	6.7%	3.9%

7 months' average: 9.3% 8.3% 3.7%
Source: Civil Aeronautics Board Form 45

Nationwide
Worldwide
depend on



Non-Regulated Operation Benefits PSA

By Harold D. Watkins

San Diego-Pacific Southwest Air Lines, while at the midst of a \$5 million program aimed at containing its explosive growth record in the rich California air transport market, is beginning to experience growth problems, called by its management as legal and regulatory challenges.

PSA's high growth situation, built by its factors, low overhead and consistent flows have established it as the leading carrier in local traffic at the San Diego, Los Angeles and San Francisco markets.

PSA's other leads at the major hubs are passenger loadings at four airports it serves. Last year, the carrier ran first out of San Diego's Lindbergh Field and the Lockheed Air Terminal in Burbank, a Los Angeles suburb. It was second out of the San Francisco International Airport—served by 39 scheduled airlines—and was fifth in passenger from the Los Angeles International Airport, served by 49 scheduled carriers.

In three of local passenger on the high-density, San Francisco-Los Angeles segment, which accounts for over 40% of PSA's volume, it is surpassed by the company at PSA's West Coast Air Lines is a close second in three of the local routes, United Air Lines is third, and Trans World Airlines is a distant fourth.

As an entrant into PSA is not sub-

ject to Civil Aeronautics Board jurisdiction on its routes (AW June 12, p. 41). In some aspects, it is a test case operation in which management is relatively free to operate at the maximum efficiency it can generate. Should PSA decide to add or drop a California city on its route, it can do so. It must get first approval from the California Public Utilities Commission, but at present this agency has little or no authority over other facets of operations.

"We think that the only similarities between ourselves and the trunk and feeder lines is that an airplane is involved," PSA President J. Floyd Andrews said.

He described PSA's methods, techniques, training and facilities as vastly different from standard airline procedures. Hark N. Wood, vice president, explained this view. "The reason for our success is that none of us knew airlines. We hadn't had 25 years of experience to learn how to get ourselves into the business. We were able to set up simple systems of inspection and control."

PSA's unregulated status as "a transportation advantage," Andrews said. "The freedom from controls over our routes gives us great flexibility. That is the biggest advantage in the aviation market of bookkeeping and paperwork. We do not have," he said.

PSA's success is illustrated by these facts:

- The sixth aircraft has just been added to the all- Lockheed Electra helicopter fleet and is now in service. Four three-engine turboprops in late 1975, replacing four DC-4s. Andrews says he hopes to add another Electra next year if passenger volume warrants the airline's traffic patterns.

- A new aircraft carrier began operation in the San Diego headquarters. The carrier, which is now being built by Lockheed, is now in service where on PSA's route to flow to this controlled operation at no extra cost to the customer. A \$400,000 NGA 515 computer is scheduled to take out reservations status control next September.

- Total revenue in 1962 rose 35% to \$24,265,000. In 1975 revenues were \$3,575,690. Net income after taxes last year was \$1,305,085, a profit margin of 9.6%.

- Number of passengers handled rose 45% in 1962 to 1,832,000. Carriers transported 250,000 in 1975. Revenue per mile flown was \$468,000 last year, compared with \$315,000 in 1962 and \$160,000 in 1957.

- Common stock was sold to the public for the first time in February at \$14 a share. Recent issues have sold for less than \$30.

- Passenger schedule adds 10 flights weekly, one more north or south, substantially more than the 166 operating ten years ago. The time schedule increases the north route.

- A 15,000-sq-ft building, primarily to house a helicopter engine overhaul facility, is nearing completion. The company expects to begin operations in its own overhaul in the \$180,000 plant in late September.

PSA schedules are concentrated on the heavy traffic lanes during weekdays. Flights are operated between 7 a.m. and 10:15 p.m., Monday through Thursday. Service is increased on Fridays and Saturdays, the peak weekend travel days. Late weekend service can reach a flight to San Francisco from San Diego in late in 1975. A Monday morning, there are 14 flight days, 49 on Fridays, 26 on Saturdays and 45 Sundays.

PSA's frequent scheduling produces a high daily utilization for the Electra helicopter. For the last four months of the year, when the airlines were operating, the average utilization was 7.6%. All five of these planes are in the air every day, with maybe a two-hour maximum layover during hours of scheduled operations," Wood said.



TWO OF PSA'S LOCKHEED ELECTRAS are tied into the San Diego maintenance base for eight-hour maintenance work. Progressive maintenance program used by the carrier results in little down time due to overhauls. PSA's flight schedule calls for all planes to be on the ground each night for maintenance.



Boeing 727 Demonstrates Short-Field Takeoff Capobility

Boeing 727 lifts off during recent short-field takeoff tests. Demonstration flights by Federal Aviation Agency certification are under way. In pre-demonstration test flights, the fast 727 took off from runway slopes upward in the test program have demonstrated more than 215 ft. of flight time. On a dry runway, at 114,600 ft. gross weight, the 727 has taken in a full stop 905 ft. after brakes were applied. On a wet runway, at a gross weight of 123,000 lb., stopping distance was 1,760 ft. No reverse thrust was used.

No load or liquid is stored on flights, and with freight containers for less than 1% of maximum gross takeoff weight is loaded on a maximum. Unloaded time at terminal points is set for a maximum of 25 min. and handling and disembarking on a three-hour flight is scheduled for 15 min.

Simple scheduling with pre-printed receipts that are collected on board by attendants also helps keep operations moving swiftly. Forward of baggage and baggage compartments from the cabin, PSA is providing 93 seats in its all-Electra configuration, two more than Western's.

California's good flying weather plays a significant role in PSA's high on-time rate which was 93.2% during the final half of 1962. PSA said it was not to outright cancellation of a single flight in 1962, although flights have been delayed or delayed for considerable periods, primarily due to fog.

PSA is not required to report its operating statistics in the manner specified by the CAB. Therefore, standardized yardsticks of efficiency are unavailable. The figure provided by H. Eugene Swartz, PSA's controller, to demonstrate the company's efficiency is total operating costs per revenue passenger mile, which was 33.8 cents in 1962.

"That's probably the lowest in the industry," he said. Inadequate is that

the average local factor approached 75% last year.

Davis maintains on the Electra in 1962 cost PSA about \$8 cents a mile, compared with a range from \$4.45 to \$5.60 cents reported by the six major carriers using the aircraft.

Major factor in PSA's operations is its progressive maintenance program, which results in virtually no down time due to overhauls. The program is possible because of plans as to the ground each night. At least every third night each Electra is declared at the main overhaul base at San Diego, where the maintenance crew takes about 15

In the time set for 12,000 hr, we will have performed all the required inspection and maintenance," Swartz said. Director Dave Bennett said. The program runs up extra costs the first year, though the airline as much as the 12,000 hr more overhaul cost begins at 200 hr, with the overhaul performed at intervals thereafter, along with other scheduled servicing. The cycle is then repeated for servicing 12,000 hr.

Actual flight schedules can be arranged so that no individual plane has more than a 12-hr. interval during the night for two consecutive jobs such as gear change.

The Alaska 501 D11 helicopter program is set for the Indianapolis plant of General Motors' Allison Div. for overhaul. When PSA operates its own helicopter overhaul shop after September, about 555,000 annually will be served as freight charges. In addition to the engine overhaul system set up with Allison, five quick engine-change jobs, after are kept ready at San Diego for emergencies. About 12 men will be added to the staff for the engine shop.

Time between overhauls on PSA's Allison aircraft was increased to 1,000 hr in all major components, among the highest in the industry.

Swartz reports that include side and main, engine maintenance work and more gear. Main landing gear will be handled exclusively after the engine shop reports. An overhaul shop is being expanded progressively.

PSA's overall estimate is that its Electra can be operated economically for 10 to 12 years. Andrews said it probably will be two to three years before aircraft thought is going to be replaced.

"However, public opinion could change that," he cautioned, if there was a strong current of pessimism for helicopters. However, none of the mail or medium helicopters is equipped with fuel and more gear. Main landing gear will be handled exclusively after the engine shop reports. An overhaul shop is being expanded progressively.

(This is the first of two articles covering the operation of the suburban California carrier, Pacific Southwest Airlines. The second will appear in a subsequent issue.)

AIRLINE OBSERVER

►Use of foreign refueling by Americans in 1962 aggregated the U. S. balance-of-payments position. Commerce Dept. figures show that \$1.5 billion of a total \$2.9 billion spent by U. S. citizens last year for foreign travel went either to foreign carriers or for expenses within foreign countries. Balance of about \$430 million was paid to U. S. flag carriers and shipping companies. By the end of the year American spending exceeded that of foreign visitors by \$1.4 billion, as compared with \$1.23 billion for the previous year.

►Domestic trunk airlines recorded an operating profit of \$12,667,000 in April, based on operating revenues of \$20,884,000 and operating expenses of \$10,814,000. Net profit for the month came to \$4,458,000 after provision for income taxes, special losses and nonrecurring income or expenses. For April, 1962, the airlines had a net profit of \$2,592,000.

►KLM, Royal Dutch Airlines, will furlough 560 pilots and 75 ground maintenance workers this year as part of its overall plan to reduce total personnel by more than 1,800 persons by the end of next year.

►Air Transport Assn. last week abandoned its proposal for a jointly financed, industry-wide advertising and promotion campaign. ATA directors said that members could not reach unanimous agreement on the project, and many felt it might duplicate already existing programs being conducted by individual airlines.

►State Dept. has selected Allen R. Ferguson, former assistant with the Rand Corp., as coordinator of the new central Office of International Aviation (AW May 6, p. 35). The office will be responsible for implementation of the international aviation policy and interagency coordination with the Defense and Commerce Dept., the Agency for International Development, the Federal Aviation Agency and the Civil Aeronautics Board.

►British Overseas Airways Corp. will place the first of its Vickers VC.10 turboprops into daily service in April, 1963, on routes to Nigeria and Ghana. By June, the non-engine-mounted aircraft will be used in conjunction with Boeing 707 equipment serving the London-Manchester and Toronto routes. The next month, VC.10s will take over BOAC routes to east, central and south Africa, and by August, the London-to-South America routes. The airline has ordered 12 standard and 10 super VC.10s.

►FAA has awarded a \$269,311 research contract for a two-year study of noise levels around airports. The firm of Skid, Bennek and Newman, Inc. of Cambridge, Mass., will conduct the study in a house for FAA testing guidelines for airport planes.

►Congress last week extended the 5% tax on passenger air travel for one year, to July 1, 1964. A proposal by Sen. Norris Cotton (R-N. H.) to eliminate the tax was defeated in the Senate by a vote of 51 to 22.

►Aircraft agreements are emerging as one of the industry's most successful revenue builders. The packages which provide door-to-door cargo shipment at one combined rate, now include 127 trucking companies and 18 airlines, exchanging traffic at 78 airports. Through handling under these agreements increased 61% during the last five months of this year, compared with the same period of 1962. Favorable to trucking companies is the airline now average \$70,000 per month and are expected to exceed \$115,000 before the end of the year.

►International Civil Aviation Organization is pressing for a greater control of VFR (visual flight) rules which permit through-way portions of controlled air space, such as terminal area and heavily trafficked airports. The added control is needed as a safety precaution because of the ever-increasing volume of air traffic, ICAO contends.

SHORTLINES

►Air France flew 8,527,700 ton miles of air cargo between North America and France during the first quarter of 1963, a 36% increase over the same period of 1962.

►Frontier Airlines reported a May operating profit of \$19,668, compared with \$45,233 for the same month in 1962. In the last five months of 1962, Frontier's operating profit has totaled \$695,316, up from the \$97,936 recorded in the same period last year.

►National Air Lines earned a net profit of \$77,800 in May, traditionally a non-profit month for the carrier. Loss in May, 1962, was \$189,000. Net profit for last 11 months of National's business year was \$6,125,000, compared with \$1,840,000 in the 1962 period.

►Northwest Orient Airlines had operating revenues of \$13,291,845 in May, and a net profit of \$685,679. Net profit for May, 1962, was \$618,360.

►Pooling arrangements for passenger and cargo services between Vietnam and Guam has been signed by Scandinavian Airlines System, United Arab Airlines and Austrian Airlines. Primary object is to reduce overcapacity on the route and cut costs. Pool flights will be three with SAS Comets and cockpit crews, and other aircraft from all three airlines. Crews said that in capacity increases, aircraft and crews of the other two will be introduced into the pool.

►Ving Airlines has inaugurated Con-Que 990A service between Los Angeles and Puerto Alegre, Brazil, via Mexico City, Bogota, Lima, Rio de Janeiro and San Paulo. One-way ticket as low as \$100. Los Angeles at 5 a.m. Friday. The carrier plans to add a Transair departure on July 9 that would serve Panama City, providing the governments resolved open traffic rights in that point from Mexico City and Bogota.

►World Airways has filed for CAB reimbursement of cargo and mail service from California to all points of the Pacific and to Asia. The carrier also asked for the right to contract the more capacity of aircraft to travel agents, who would sell the space to charter and tour groups.

►Pacific Northern Airlines showed an 11% increase in passenger volume in May, carrying 37,554 persons compared with 15,817 in May, 1962. Cargo volume in May rose 6.7% over May of 1962.



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DEFENSE CONTRACT AWARDS

SECOND FISCAL QUARTER SUMMARY—1963

Now available free from AVIATION WEEK & SPACE TECHNOLOGY are summary reports of defense contract dollar awards covering the second fiscal quarter of 1963. These reports show defense dollars awarded in 179 product/system categories as compiled by Frost & Sullivan, Inc. Information is also available on the second fiscal quarter 1962; third fiscal quarter 1962; fourth fiscal quarter 1962; and first fiscal quarter 1963.

Reports are available on an individual request basis in the following system areas:

Data Processing
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Electronic Warfare
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Alcoa's Carl Anderson speaks with authority on hollow extrusions in aircraft alloys.

This is the man who took the welds and weaknesses out of hollow extruded shapes





Alcoa's
Carl Anderson
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with authority
on hollow extrusions
in aircraft alloys.

Carl Anderson is superintendent of Alcoa's biggest extrusion plant. With two 14,000-ton presses and a 3,000,000-lb stretcher at his command—plus his 20 years' experience in extrusion technology—he stays a step ahead of the competition and turns out a quality product that keeps other extruders of aluminum scratching their heads.

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AERONAUTICAL ENGINEERING



MODEL OF CESSNA YAT-37D attack trainer is shown in two views above. The aircraft is to be evaluated by USAF for counterforce power operations; will be designed to carry 3,000 lb. of unarmament and have short-field takeoff and landing capabilities.

Power Increase Planned for COIN T-37

Cessna YAT-37D attack trainer to be evaluated by the U.S. Air Force for counterinsurgency (COIN) air warfare capabilities, will have more than twice the engine power of the two-seat T-37B trainer from which it is derived.

This will enable it to carry 3,000 lb. of unarmament while retaining favorable short-field landing and takeoff characteristics.

The T-37B will be converted by Cessna Aircraft Co. to the new YAT-37D configuration under an Air Force letter contract providing advance funding of \$609,306 (AFM June 24, p. 51).

The speed with which the program is being pushed is indicated by the fact that Cessna has just 25 weeks to prepare the airplane for flight tests. After contractor testing, they will be turned over to the Air Force for flight evaluation in simulated combat at the Special Air Warfare Center, Eglin AFB, Fla.

Basic of the YAT-37D program is modification of an existing airplane. The new trainer replaces so that it can take on two additional, loaded seats with a minimum of new development or the release. Actual concept considers replacing modified engine, water radiator, equipment, to already longer powerplants, particularly underdeveloped counter, so they can enjoy their air levers with a low cost training airplane.

Should an emergency arise, such as a bushy outburst of the power must be guaranteed quickly from the U.S. could verify such a powerplant, piston and other technical equipment and the system could provide be converted to counterinsurgency air warfare aircraft.

This type of approach could help ensure that, with the U.S. withdrawing combat equipment, these counterinsurgency aircraft could be used for other purposes, such as for training or for other purposes.

Providing the added combat capabilities to the basic T-37B trainer requires these engine changes, which make

up the YAT-37D configuration.

- Substitution of the T-37B's standard 1,035-hp-constant speed 199T23 turboprop with General Electric T35-CR-5 engine rated to 2,400 hp (above).

This will permit an increase in the gross weight to 16,700 lb., almost 4,000 lb. heavier than the T-37B trainer version.

Although the J35 will provide more than double the original power available it weighs only about 50 lb. more than the J49, and with slight modification—mainly in an armature accessories to reduce its envelope diameter—will fit the same "hole" in the wings. Replacement of accessories required will be possible by taking the accessory drive from the GE C240 engine and adapting it to the J35-5. These modifications will also be necessary in the forward air base engine mount structure to accommodate the J35's differing engine support points.

During of the J35 from its removal 1,800 lb. thrust will be done by an engine of the J35-5. This is due to the engine's power about a 15% improvement in engine specific fuel consumption. Engine rollers in the wing will be replaced approximately 10% to provide for larger clearance, and the boundary layer ducts for the J35 will be deleted.

Shape of the wing's leading edge as it will be moved slightly to a more circular shape. Retractable fuel vent will be fitted for evaluation to see if this can account for operation from rough fields.

Engine thrust attenuator down, aft

YAT-37D Performance

Engine	
2 GE J35 at 2,400 hp, fixed pitch	
Takeoff gross weight	15,500 lb.
Landing weight	8,215 lb.
Empty weight	5,195 lb.
Load capacity (with 100 seats)	3,990 lb.
Takeoff distance, ground roll	1,650 ft.
Takeoff distance, over 50 ft. obstacle	2,105 ft.
Landing distance, ground roll	815 ft.
Landing distance, over 50 ft. obstacle	1,110 ft.
Rate of climb, gross weight	5,510 ft./min.
Maximum rate of climb	27,610 ft./min.
Cruise speed	110 mph at 10,000 ft.
Cruise altitude, over land	5,000 ft.
Average cruise speed, over land	275 mph.
Cruise climb rate	15,000 ft./min.
Maximum cruise speed, internal	210 mph.
Total mission time	1.75 hr.

All performance data are estimated. Combat radius and engine exhaust counterpoint are single-engine cruise as standard operating procedure, as determined by mission. Cruise rate can allow approximately 10% more time and 30 more cruise time plus normal fuel reserve on return to base.



"Don't tell me about 99% quality. Would you ride in it?"

(From an imaginary but realistic exchange between a TRW Defense Board and TRW)

Defense Director, Sec of Def: This thing has hundreds of components. Put in just one that's only 99% good, and there goes your mission.

TAPCO: I didn't mean 99% performance. Our stuff works. Our reliability factor is 30 and five or six times more often, sometimes we express it in thousands or tens of thousands of hours mean time between failures. Or a failure probability per cycle of one time in ten to the minus eight power. That's as close to perfection as you can get.

Def: But you need 99% quality.

TAPCO: Right. Quality. Actually, it's 99.9%. We're allowed better than 10 million errors and almost no errors, components, parts—no test results, AFU's, fuel pumps, gun motors or Of all

these just six-tenths of one percent required corrective action.

Def: Let's hear about them.

TAPCO: Sure. Most of those problems were in the early test-off stages. In many cases the problem wasn't quality control but communications. We and our customer didn't reached complete understanding on requirements, check-out procedures, or test-rundown correction, the sort of things engineers and quality people get together on and look out.

Def: I hear you. But would you ride in it?

TAPCO: Yes, I'd ride in it.

If you'd like to continue this conversation in terms of your specific requirements, write A. A. Pesta, Director, Requirements and Contracts, TRW, 30300 Eland Ave., Cleveland, OH, 44130.

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of the tailpipes, can be collected readily to reduce thrust to a desired level of 70 lb while the J44-6 at 55% power—the same reduced level as is achieved on the less powerful T-738, although the more powerful General Electric tailpipes produce 570 lb thrust while at ground idle power of 475. Tailpipe temperatures of the two engines are approximately the same, requiring no air separation in fabrication of the YAT-37D's atmosphere.

Increased fuel capacity is provided by addition of 50-gal. fuel wing tanks and 100-gal. disposable wing tanks to the internal fuel tanks. YAT-37B normal internal fuel capacity is 230 gal., but replacement of standard tanks with U.S. Rubber self-sealing types to reduce vulnerability against small arms fire reduces normal internal capacity to 225 gal.

Fuel system isolation and management will be the same as the T-37B, with additional fuel capability being provided to feed the larger engines by doubling up the proportional pumps on each side of the fuel system. Tip tanks merely transfer fuel into main wing tanks and an optional third. The disposable wing tanks are interconnected directly to the main system's proportional fuel pumps.

Leading edge airbrakes will primarily provide strong lateral support, increasing lift/drag characteristics of the nose and nose landing gear to improve



Two-Seat F-105F Makes Maiden Flight

Republic Aviation Corp.'s new two-seat, all-weather supersonic F-105F appears to be a leading aircraft making its first flight recently. The 1,400 mph. jet will have the same speed capability as the single-seat F-105D version, but also will be used to improve the current two-seater program for combat pilots. Use of the F-105F is expected to stimulate the need for additional jet trainers and the need for close liaison during training flights. Only major engineering changes required in the conversion of the single-engine design to a two-seat design was a 31-in. extension of the fuselage and a propellerless intake in the length of the tail fin to incorporate two seats. This was done by Republic's chief test pilot, with second cockpit empty. Note how fuselage extended at rear of fuselage.

performance when operating from short, rough fields. The use was made in a test which reflect those in the discipline.

On the nose gear, the main wheels will slide into the engine underwing skin cowls, but the landing gear doors will have to be modified slightly to cover the protruding fairings. On the nose gear, the replacement is much simpler. The standard wheel will be replaced by dual wheel assembly on the YAT-37. This had been replaced by a smaller wheel to improve ground steering. It is expected that the steering gear in the forward shock absorber will be moved to accommodate the higher landing loads required and possible nose gear jacking up will be made as the structure adjacent to landing gear struts changes. New shock absorbers will have landing capacity increased 400%.

Armament Precision

An armament will be provided by firing a single 7.6-in. General Electric ramjet— a rotating chamber-type weapon with a firing rate of approximately 7,000 rounds per minute in the nose, and pairing three detachable pylons under each wing. Two advanced pylons will be capable of carrying 150 lb of stores each and the outboard pylons 500 lb of stores.

When a given fuel tank is fitted to the aircraft, it would be parked on the fuselage without pylons. Stores could mount of general purpose bombs, napalm tanks, gun pods, rocket pods and electronic reconnaissance pods in

combinations required for particular missions.

Rattle-type gunights will be mounted in the cockpit to provide aiming for all weapons. Weapons selector switches will be mounted on the forward edge of the dashboard, in the nose cowl at the weapons are mounted, to facilitate operation without causing the pilot to direct his own attention. Provision for a gun camera will be made, and there will be a capability for entering vertical and oblique vision in the field, for reconnaissance or strike target photo coverage.

Cockpit Controls

The cockpit will feature dual seating and controls to maximize reconnaissance capability in the low-level type of mission. Two large control sticks will be mounted on the sides of the cockpit, each with a control stick, and there will be a capability for entering vertical and oblique vision in the field, for reconnaissance or strike target photo coverage.

Crew will be protected from small arms gunfire by lightweight armor under the seat.

Electronic will include AN/ARC-11C Tapes navigation equipment, AN/APN-44 DTT (data link), frequency AN/ARC-14 FM communication and AN/ARA-51 PDS (power) and AN/ALN-19 ADF. Under discussion are sophisticated Decca-type navigation gear and low-light level instruments, the latter for target acquisition.

The two aircraft have converted to the YAT-37D configuration actually on the nose which the Special Air Warfare Center evaluated late last year.

At Elgin AFB to study the potential value of the light transport mission in the CON role.

These T-37As were modified slightly from the basic configuration, by fitting them with wingtip fuel tanks and an external stores pylon under each wing to study their suitability as a weapons platform and their general handling and operations characteristics.

Missile Availability

According to Chinn, mission availability of the airplanes was high—only cut short in 50 scheduled missions. The main cause of an airplane was not ready to go was due to support and maintenance of a voltage regulator, which caused the starting battery to run down. Visibility, maintenance and availability in a weapons platform was rated high by Air Force observers during the test program, according to these same sources.

The YAT-37D's most immediate customer is the North American Aviation Columbus Div. converted YAT-37B tailpiper. Although the first program of the airplane involved testing the conversion testing program (AFM, Apr. 1, p. 10), it had just left the factory through its tests to be improved. Air Force observers with its potential capabilities and USAF is currently negotiating a contract for a second test vehicle to carry the project through a complete evaluation. A T-37 already has been delivered to the Columbus Div. and is awaiting go-ahead to commence conversion.



First prototype of the Sikorsky SA-3120 Super Frelon is demonstrated at the Paris Air Show. Head-on view shows boat hull design for amphibious and vehicles for the three turbo-shaft engines along the cabin.

Both Super Frelon Prototypes Flown in Demonstration

Work is being done by the first prototype in a demonstration at the show (below). Using its hoist system, the Super Frelon can carry a maximum load of approximately 7,500 lb.



First two prototypes of the Sikorsky SA-3120 Super Frelon were flown at the Paris Air Show. First prototype (facing page) is configured to Army specifications. The second helicopter (this page) is the Navy version. Principal external difference is the two air ducts mounted to the rear loading gear doors in the Navy version. Although the Navy prototype is equipped with the rear loading cargo door (right and below) of the Army version, it probably will be eliminated in any production version. It requires vertical movement. While the door will be retained in the Army version, the configuration will be changed to eliminate aerodynamically caused vibration on the air ducts and tail boom (AW June 28, p. 40). Both prototypes are powered by Turbomeca Turmo 50 development version of the Turmo 3C engine, scheduled for production helicopters. Each of the three engines in the production ship will be rated at 1,318 shp.





Armament carried by the Mirage 3 includes several types of air-to-air and air-to-surface missiles. One configuration shown at Paris (below, left) included a Matra 530 air-to-air missile mounted on the belly and two Sidewinder air-to-air missiles on the wings. The Mirage 3C (below, right) carries a single missile of the Nouvel Air 20 type mounted on the belly. This weapon was being developed in both air-to-air and air-to-surface versions.

Mirage 3 Shows Varied Weapons, Auxiliary Rocket



Operational version of the French Dassault Mirage 3 fighter jet shown in various configurations from a high speed dive to a landing touchdown at the Paris Air Show. Three different types of missiles are shown (bottom, facing page) on two different aircraft. Formation of Mirage 3C (above) carries latest air-to-air and air-to-surface missiles. Details of the secondary boost SEPR 544 rocket firing under the tail as visible (right) with the airplane in a banking attitude with wing speed brakes extended. Heat waves from the jet exhaust are discernible against the track as the Mirage 3 goes head-down (below). Low level, high-speed flyby before the Paris Air Show carried at Le Bourget airfield is made by a Mirage 3C in standard markings (above, facing page). The Mirage 3C is the standard operational configuration version of the fighter which is powered by a SNECMA Atar 9K turbojet engine with afterburner, rated at 13,250 lb. thrust.



STATE-OF-THE-ART REPORT ON SOLID PROPELLANT ROCKET MOTOR DEVELOPMENT AT UTC

Dramatic refinements in solid rocket motor technology during the past few years have greatly increased their usefulness.

High-performance solid propellants, segmented motors, extended duration nozzles, thrust vector control, lightweight fiberglass casing, and simultaneous ignition of solid propellant clusters have all been successfully demonstrated—in the past 18 months—at United Technology Center. Current rocket motor programs at UTC apply the simplicity and reliability of these improved motors to such uses as giant boosters, upper-stage components, retro- and sounding rockets, and "hi-G" assignments for anti-missile weaponry.

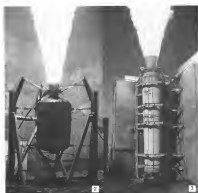
■ UTC pioneered the concept of large segmented solid propellant booster motors, and is prime contractor for the first stage of USAF Titan III C, the Standardized Space Launch Vehicle. Together, the two 120-inch segmented solid propellant motors which make up this booster stage will generate lift-off thrust of over 2 million pounds—more than 80% of the vehicle's total thrust. Identical motors, fired in larger clusters, could achieve the very large lift-off capability required for any space mission now planned for this decade.

■ Research and development programs at UTC—company funded and contractual—cover a broad spectrum of propellant: solid and storable liquid propellant rockets, and hybrids. The company's facilities, production capacity, organizational experience, and backup by United Aircraft Corporation equip United Technology Center to handle a variety of advanced propulsion assignments.

UNITED TECHNOLOGY CENTER



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1. Segmented solid rocket motor. The concept of large, segmented, solid propellant boosters, first advanced by UTC in 1959, has been brought to reality at the company's Cayote development center. Here, giant test rigs have capacities up to 4,000,000 pounds of thrust.

2. Early feasibility test image demonstrated the efficiency of UTC's unique design, first key to the development of reliable segmented solid propellant rockets. Subsequent tests included the nation's first practical segmented fiberglass case motor.

3. Company Fueled R & D overcome initial problems of large segmented solid propellant boosters: core design, exit nozzle, and thrust vector control. Test of USAF Titan III C motor verified UTC's preliminary results.

4. Clustered Solid Propellant Motors verify UTC's development of serial assembly of motors for achieving several launch applications. Clusters of large solids can provide tons of millions of pounds thrust.

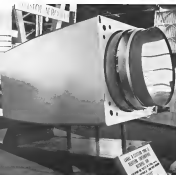
5. First 120-inch Motor Fired under USAF Program R2A produced peak thrust of 250,000 pounds during two-minute firing. Single segmented test is first step in UTC's Titan III C development program.

6. USAF Titan III C. The first stage of this Standardized Space Launch Vehicle, consisting of two five-segment solid propellant rocket motors, 120 inches in diameter, will give this vehicle more than 2 million pounds of thrust at lift-off. It will orbit multi-ton payloads to low and medium altitudes.



Behind Sikorsky display at the Paris Air Show is an engine with the basic configuration of the 35,000-lb thrust Olympus 553 turbojet scheduled to go into the Anglo-French Conquest Mach 2.2 transport. Engine in show configuration is 30 ft. long.

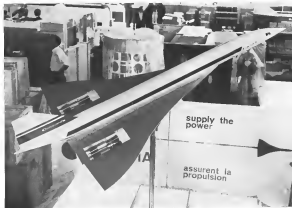
Olympus Engine Configurations Shown at Paris



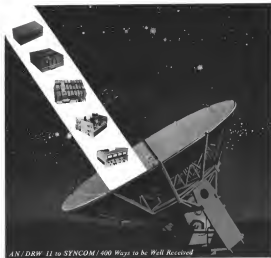
Saunders exhibit at the Paris show features a model of the basic engine and afterburner unit the French firm is developing for use with the Olympus on the Conquest. Afterburner system is designed to provide the engine with approximately 20% additional thrust to push the Conquest through the transonic speed regime into supersonic flight. Rear view of Saunders model shows tooth-like design structure for the engine's afterburner.



Rear view of Olympus shows Bristol Siddeley-designed afterburner unit to be used on the Olympus 561 which will power British Aircraft Corp.'s TSR 2 tactical strike-sustainer fighter under development for the Royal Air Force.



Conquest model shows the general placement of the first Olympus powerplant in the aircraft's delta wing. Note the square inlet shape, which has been designed to combine with the Saunders afterburner exhaust.



AN/DRW 11 to SYNCOM/400 Ways to be Well Received

Since 1958, when it first built the AN/DRW 11 (a receiver whose primary function is to destroy misleading signals), STL has produced more than 400 space communication receivers of 14 different designs. The Able I receiver, the first phone-book receiver ever to fly, was built by STL. So was the ground station parametric amplifier that tracked Pioneer V 35 million miles into space. STL built the receiver now being used at Perimeter Station, France, to track America's first communications satellite. The voice communications receiver for SYNCOM and the space command receiver for NASA's OGO are both STL products. Scientists and engineers interested in advancing the art of space communications will find Space Technology Laboratories an active place.

STL builds spacecraft for NASA and Air Force-ARPA, and coordinates Systems Management for the Air Force's Atlas, Titan and Minuteman programs. These activities create immediate openings in: Space Physics, Radar Systems, Applied Mathematics, Space Communications, Antennas and Microwave, Avionics Computers, Computer Design, Digital Computers, Guidance and Navigation, Electromechanical Devices, Engineering Mechanics, Propulsion Systems, Materials Research. To obtain additional information regarding positions at Southern California or Cape Canaveral, you may contact Dr. R. C. Porter, One Space Park, Suite A-1, Redondo Beach, California, or P.O. Box 4277, Patrick AFB. STL is an equal opportunity employer.



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SPACE TECHNOLOGY

NASA Studying Lunar Base Feasibility

By Irving Shaw

Los Angeles—Basic reference concept for a lunar base will be presented in a four-month engineering study in early fall pending for Headquarters, National Aeronautics and Space Administration. Contractor selection for the task is expected to be made before mid-July from a group of industry bidders (see box p. 72) which submitted separate technical and management proposals early last month.

This study will be the first in a continuing program expected to continue in early to mid-1970, to obtain sufficient technical data so that NASA management can decide whether a lunar base should be developed.

After the initial study is under way, NASA will begin a number of separate investigations which will examine in more detail specific technical issues, such as the base powerplant, life support systems, and other key considerations. These will be supplemented by operational and logistic studies, as well as analysis of any technical facilities which may be required. When all of these studies are completed, a second overall concept study may be initiated.

All of the studies probably will be directed or coordinated by NASA's Office of Manned Space Flight, but direct technical supervision will be performed by a number of organizations. Some of the studies will be administered from NASA Headquarters, others will be administered through the various NASA centers, and some may be managed by the Army Corps of Engineers.

Manned Spacecraft Center will have cognizance of the life support system and the Army Corps of Engineers will have supervision of the nuclear powerplant and representative facilities studies for the lunar base.

Spacelab place for post Apollo lunar exploration probably won't be established for some years. Area of uncertainty includes the power system of the lunar environment, level of landing in lunar opposition, and relative impact area of lunar missions. While use, life span and purpose of a lunar facility will vary for specific missions, all the facilities will be required to provide shelter, life support, power, communication, and assist in surface mobility operations.

The lunar base concept will under some variations in lunar facilities, but will retain enough flexibility to ac-

commodate the uncertainty of lunar operations.

A lunar base system will consist of a group of prefabricated modules which can be assembled in areas on or below the lunar surface, to support a range of missions. The overall design will facilitate expansion to increase capacity and decrease dependence on resupply from earth. The base concept will consider three key features.

• **Modularity** of the lunar base system will be transportable on lunar logistic carriers expected to be operational in the 1970-1975 period. This indicates transport-

ability on both Saturn V and large logistic vehicles.

• **Payload** capability imposed by Saturn V means that diameter of the spacecraft bus and payload will not exceed 160 in. Height above the lunar surface of the land-carrying platform of the bus will be 70 to 700 in. Ultimate launch acceleration will be 1g, and ultimate lunar descent deceleration will be 10 m/s². Maximum payload will be 25,000 lb. Maximum lateral deviation of payload center of gravity from positive axis of the bus will be 14 in. Height of payload center of gravity

will be 14 in. Height of payload center of gravity

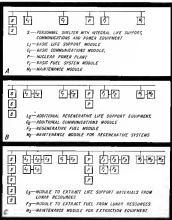


CHART A SHOWS THAT LUNAR BASES which are larger than the simplest single module personnel shelter (S), with its integrated life support, communications and power equipment, will need additional life support, communications, power and maintenance equipment. Extended mission bases (chart B) will need additional regenerative life support and fuel equipment, plus communications and maintenance facilities to support the equipment. Larger bases (chart C) will need additional equipment to extract subsurface fuel and life support materials from lunar resources.

Williams Cites Mercury Problems, Contributions to Future Missions

Los Angeles—Project Mercury's air-tuned flights have written "the book," as a consultant to future manned space missions, according to Walter C. Williams, associate director of Research, Development and Operations Director of the completed Mercury program (AW June 17, p. 30).

Williams summed up Mercury program experience recently at the Astronaut Institute of Association and Astronautics summer meeting here.

Primary lessons taught by the four orbital and two sub-orbital Mercury flights was the value of attention to detail, Williams emphasized. He is reported to have questioned authority during the Gemini and Apollo programs.

Medical Changes

Determining the Mercury program's problems and adjustments, Williams said that medical changes first noted during the sub-orbital flights of Navy Cadet William M. Serrano, Jr., became more pronounced during the 22-orbit flight by USAF Maj Gordon Cooper. One of the most significant was what Williams called as a "orthostatic type

reaction," the medical term for lowered blood pressure resulting from a change from a supine to an erect position. "This was a pooling of blood in the legs, that became much more pronounced than it was with Serrano," Williams said.

Lowered blood pressure is believed to be the cause of Cooper's momentary disorientation when he stepped from the Mercury capsule. "The effects seem to be post-flight," Williams said, "and occurred from 15 to 24 hr."

Exercise in the capsule, such as that performed by Serrano's command, may be the solution, he added. However, Williams said, a question remains as to the exact cause of the hypotension. Before specific recommendations are made for future space missions, more understanding of the phenomenon is needed, he said. "One medical people are looking at it," Williams added.

Weightlessness contributed to several of Mercury's most spectacular problems and persistent ones, Williams said. Several problems in the MA-9 capsule were traced to a single electric short caused by moisture. The failure of the circuit forced Cooper to fore-

go using the automatic attitude control system (ASCS) to depress re-entry outboard, and to fly manually instead (AW June 3, p. 22).

Moisture leak connections in the cabin shouldn't have caused a problem, according to parajet chief Williams said. "We had run all the acceptance tests to check out the connections, including a salt water test. But those tests were at 100%," he said. In the absence of gravity, moisture slipped in and around the connections much more easily than when gravity was present, and caused the short, Williams said.

Debris, Dirt Problems

Debris and dirt also became potentially critical problems in a number of conditions, he noted. Although the episodes were troubled four to five times prior to launch, debris was still a problem, and there was the danger that it would enter wind shields. This hazard must be considered during design, and shields and other susceptible components must be protected, Williams said. "This dirt and debris problem is just going to have to be expected," he added.

Necessity for close attention to all details was further emphasized in several other problem areas, Williams said. There is continuing concern with quality control, escape system, life support, and temperature controls, plumbing

pipes and joints, and heat balance control within the pilot compartment, he noted.

As an instance of the importance of minor details, Williams cited the failure of four out of five explosive charges to initiate catapult drops properly during the MA-9's eighth mission. The four had fired as commanded, but lacked sufficient charge to start the sub-orbital coasting.

An investigation determined that the four defective charges contained only the small charge used to give a slight pop for ground testing. The proper and operational charges were salvagable as appearance, except for a color washer.

It was determined that whoever loaded the charges used on MA-9 had put in the test quantity, but then had loaded the charge with the right code.

touching between light weight and high strength in design.

Lockheed Propulsion Co. has a \$1.5-million contract from Army's Nike Zeus Project Office for participation in preliminary development for the Sprint missile program. Work will be done at Lockheed's Redlands, Calif., plant.

Korbett Co. of General Precision Associates, Little Falls, N.J., has a contract of \$1.5 million contract from Manassas, Va., for 200 Alpha sensors for the Titan II booster.

General Dynamics/Astronautics, San Diego, Calif., has been awarded a \$911,000 National Aeronautics and Space Administration contract for designing and developing a beam rider, a model's life support system for space missions. It will include air and temperature controls, water management, hygiene and sanitation, sensors, displays and instruments.

Kerthorn Co., of Andover and Redford, Mass., has a \$900,000 Army letter contract for development work to extend the capacity of the Hawk missile to engage targets at higher altitudes than might be encountered by a field army.

(Continued on p. 75)

PRODUCTION BRIEFING

Nike Zeus Project Office at Redford Arsenal, Mich., has awarded a \$700,000 and a \$170,000 feasibility study contract to Thiel Chemical Corp., Bristol, Pa., and Aerojet-General Corp., respectively, for a new solid propellant for the Sprint missile.

Kollman Instrument Corp., Elmsford, N.Y., has been awarded \$1.3 million in sub-orbital tests for work on Air Force's AN/DQ-18 electronic photo mapping and survey system. Tests planned for the program now stands at \$6.7 million.

Spartan Phoenix Co. has a \$8.5-million contract from Douglas Aircraft Co. for automatic flight control system for the DC-9 jet transport.

Defense Electronics, Inc., Redford, Mich., has a \$5.5-million Air Force contract for procurement of a telemetry receiving and storage subsystem. Work will be done at Redford.

General Precision, Inc., Tarzetta, N.Y., has a supplemental Air Force contract for \$1.5 million for work on a space flight simulation system. Work will be performed at Elmsford, N.Y.

Cerius-Wright Corp. has a contract from Air Force Systems Command Research and Technology Dept. for design, fabrication and testing of four ultra-high strength, ultra-low modulus, ultra-low cost. Cases will be made from 18% nickel cast alloy steel, which the company believes is the optimum alloy.



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AND COMMANDER, INC. SEATTLE, WASHINGTON DIVISION OF ROBERTS INDUSTRIES CORPORATION

Food Motor Co., Aeromarine, Inc., Newport Beach, Calif., has a \$49,900 firm Army contract for research and feasibility studies for remote powertrain units.

First squadron of Atlas 2 ICBMs has been assigned at Dec-Miss than AFB, Tuscon, Ariz., was month ahead of schedule. The next squadron (to be assigned) will be at Little Rock AFB, Ark. All on squad was at the three Vost 2 jets. McCoswell AFB, Kan., Dec-Miss and Little Rock—was expected to be assigned before the end of the year.

Short Skyway prototype, which flew in January with two Continental piston engines, is being retrofitted with two Teledyne Avco turbo-prop powerplants. Company says early day problems have been solved by changes in nacelles and landing wing structure. First flight with Avco turbo-prop is scheduled for this month.

Messner Mfg. Co., Barab, Calif., will design and build the landing gear for the Douglas DC-9 transport under a \$3-million contract which includes initial engineering and detailed project completion. First scheduled component to be scheduled for delivery to Douglas in September, 1964.

Whittaker Controls and Guidance Div. of Teledynamics Corp., Los Angeles, Calif., has a \$500,000 contract from Boeing Co. for design, development, test and production of liquid engine test cells and test cells for the S-3C bomber of Stratix.

Clemons Inc. Works, Houston, Tex., has awarded a considerable contract for the construction of a super-cold alloy steel and steel resistant alloys for space applications.

An Reduction Plastic Co. will quadruple production of liquid nitrogen to 105 tons per day in 1964 at its City of Industry plant near Los Angeles, Calif. The \$1.5-million expansion program is planned primarily to meet the needs of the Southern California aerospace industry.

Leon Siegel, Inc.'s Astro Structures Div., El Segundo, Calif., has been awarded a \$151,000 contract from Aerotech Products Div. of Federal-Mogul Rubber Bearings, Inc., to manufacture large-diameter rubber disk liners for the Saturn boosters.

HEP, Inc., will begin immediate expansion of its Columbia, Minn., aerospace preclinical plant to meet growing demands for telepropellant products.

Rombus Study Keyed to Post-Nova Effort

Los Angeles-Rombus, a single stage manned space-cargo carrier which might be used 20 years or more was described at Aeronautics Institute of Aeronautics and Astronautics summer meeting here.

Designed as a reusable orbital and sub-orbital and utility shuttle (AW Apr 29, p. 26), the man-orbitable vehicle is planned to have a land-recovery capability.

The concept of Rombus was outlined by Philip Boes, chief advanced project manager of future space systems at Douglas Aircraft's Missile and Space Section Div. Although Douglas does not presently Rombus as a study for National Aeronautics and Space Administration, Avionics, Weapons & Space Technology has learned that it is just at a post-Nova NASA vehicle analysis.

Propulsion System

The propulsion system was a liquid hydrogen-fueled engine with a plug nozzle to aid in improving the aerodynamic burning of hydrogen. Fuel would be used to cool the re-entry body. The propulsion system would be used for orbit injection, apogee, and for landing retro-thrust. Landing would be on a 10 to 15 ft. landing gear, with the main gear, offset, and, with the main gear, but the plug nozzle increasing the drag.

Parachutes and retro-thrust of the main engine would slow the vehicle's landing, and four removable legs would be used for touchdown.

Rombus could be developed by the late 1970s, according to Boes, who said that recovery tests would show the recovery would be true and half-mile range.

Reent Fuel

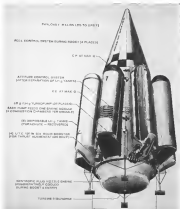
Fuel for orbital boost would be provided by eight detachable fuel tanks strapped around the reentry vehicle. The tanks would be jettisoned, when fuel is expended, to improve flight performance and maneuverability during recovery.

Parachutes would lower the tanks back to earth for recovery.

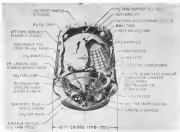
Total length of the re-usable portion of Rombus is 95 ft., and base diameter is 60 ft. During descent from orbit, this main section of Rombus would weigh approximately 1.5 million lb.

Preliminary estimates indicate that postpaid per pound-to-orbit cost could be reduced to about \$12 for Rombus, with only six tons.

After 20 trips, the cost would be reduced to \$5 a pound.



ROMBUS SPACE-CARGO CARRIER, under study for National Aeronautics and Space Administration by Douglas Missile and Space Systems Div., is shown in two drawings, with callouts describing subsystems and components. Entry configuration is shown at bottom.



V/STOL Aircraft Studied in Simulator

By David A. Brown

Harrier, Cobra—Variety of vertical lift and compound aircraft are being flown from United Aircraft Corp. Sikorsky Div.'s V/STOL flight simulator here before any actual hardware is built.

Sikorsky is capable of representing helicopters, compound helicopters, tilt-wing, tilt-rotor and lift-engine or deflected exhaust VTOL aircraft.

Three of the configurations being tested were flown by this American Women & Service Technician pilot and despite the lack of motion, sound or visual cues, representation was good and, with some practice it was possible to do the various configurations through a variety of maneuvers.

Simulated aircraft flown included:
• Tilt-wing V/STOL aircraft, powered by General Electric T56GE-6 turbo shaft engines and using differential power, altitude, direction and yawed lift to provide control in hovering condition. Aircraft had a gross weight of about 15,000 lb.

• Compound helicopter with a main rotor gross weight of 75,000 lb and a disk weight for the particular flight of 90,000 lb. Helicopter was powered by two engines of the General Electric T64 class and was capable of flying at 215-300 kt. at an altitude and 125 kt. at a heloaltitude.

• Heavy assault helicopter similar to the Sikorsky CH-53. Helicopter was

equipped with an auto flight path system which allowed it to fly a pre-determined mission—in this case, a dual-task, anti-airborne cannon—speeds and within tolerance virtually impossible for a human pilot to achieve.

Tilt-wing V/STOL was flown initially with an auto-stabilization device and an automatic altitude control so operation and later with varying degrees of auto-stabilization off. Transition from hover to forward flight was made with the stabilization system on.

With both auto-stabilization and attitude control, however, the aircraft was not difficult, although lateral motion was sluggish and hard to control.

Roll Control

At least, roll control is provided by differential outboard engine power alone and an auto flight roll control is provided by the altitude alone. Its yawing, roll control is provided by a yaw damper. Altitude and differential engine power, with the altitude being used to take effect as the wing tucks through the 90-degree position on the way down to the lift 60 deg. position. Altitude is fully effective in the wing tuck at the 41 deg. position.

The outboard engines begin to have differential power capability at the 10 deg. up position and are completely effective after the wing has been rotated to the 77 deg. up position.

Pitch control in hover is provided by

two ducted fans mounted in the horizontal stabilizer of the aircraft's T-tail, and yaw control is by a single ducted fan mounted in the vertical fin as well as by differential ailerons.

Altitude used for yaw control in this configuration is completely effective between the 90 and 80-deg wing position and progressively less effective until the wing reaches the 41-deg position. This is exactly the opposite of the ailerons from end to roll control, so that when the ailerons are in effect in one area, they are fully effective in the other.

The ducted fans in the horizontal stabilizer, one on either side of the vertical fin, are 4 ft in diameter and can exert a force of 3,000 lb in either direction. The single ducted fan in the vertical fin is 5 ft in diameter and exerts a force of 2,340 lb in either direction.

The rudder and elevator are limited with regard to dynamic force or torque, but the elevator can rotate, and the motor wing is covered with aileron from the propeller.

At auto-stabilization along various axes was tested off, the aircraft became increasingly difficult to handle. Yaw was fixed to the yaw control, and the aircraft could be flown with both yaw and roll unaided.

With the pitch stabilization off, however, it was not possible to prevent V/STOL from beginning a steadily increasing pitching motion which rapidly became unacceptable.

The present V/STOL was equipped with standard helicopter controls. Wing lift was controlled by a dual-switch on the collective control.

Flight Transitions

Transitions were made from hover to forward flight and back with the auto-stabilization system on. There is no critical speed for wing tilt, since with full flaps, the aircraft would hover with the wing at the 67 deg. position. Flaps also are controlled by a lever on the collective.

From a hover, the aircraft was started forward by tilting the wing-lift lever on the collective back, thus swinging the wing forward from its vertical position toward a horizontal one.

Lateral speed was still difficult to control, especially while angled was relatively low. As the wing continued forward and speed increased, flaps were used. Flap operation is not entered as transition from hover to forward flight, although it is necessary when coming into a hover, especially because it is needed to full forward speed.

Transition back to hover was made by lowering the flaps, then tilting the

wing up while maintaining a constant heading.

The wing was started up while the aircraft was still more than 1,000 ft high and a steep nose-down attitude was necessary to enable the aircraft to lose altitude. This descent appeared to be much steeper than it actually was since the fuselage was not rising as the wing tilted plane in the wind.

In both the tilt-wing V/STOL and the compound helicopter, one of the greatest problems encountered was shifting in the air flow helicopter operations in engine operations and back again. This can be considered as a problem in an actual aircraft, but in a simulator it prevents a large psychology of hover.

Compound Helicopter

The simulated compound helicopter had a gross weight of 55,000 to 57,000 lb and was a VTOL aircraft only. In lighter weights, as programmed into the simulator, it had a gross weight of 44,000 lb and was capable of vertical lift and hovering flight.

Aircraft was powered by three ground turbine engines of the General Electric T64 class and had both helicopter and complete assault capability. Sikorsky engineers emphasized that it was a dual design only and not a true helicopter.

As a helicopter the machine was capable of flying at about 125 kt. when a transition was made to airplane flight and the rotor placed in auto-rotation. In the airplane mode, the machine had a design speed of about 218-300 kt. if tested level.

Control down in the simulator was found to be quite light and this resulted in a sense of over-control. However, the simulator was not difficult to fly from a mechanical point of view, but the chance of over-reaction, level in both the controls and the body and some visual references usually available produced additional difficulties.

Visual Cues

Conditions were set up in which the pilot was 180 deg. out of phase with the pencil visual cues provided by the control mixing system. Transition was a tight turn, for example, to turn further to the right rather than rolling out to the left to continue on a straight course.

This condition was reported to be extremely concentrated using pen cues also by the simulator on the simulator. Addition of kinesthetic, vestibular and audio cues, plus blocking out of view of the simulator room which tends to be distracting to the pilot, should improve the situation of flight.

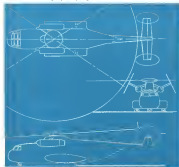
Transitions from helicopter to airplane flight was demonstrated in the simulator of forward transition. At 125 kt. with a manual control of the flaps, the wing flaps were raised down and



TIPT-WING V/STOL aircraft flown in the simulator is powered by four General Electric T64 engines. Note ducted fans in horizontal and vertical fin sections for pitch and yaw controls in hover. Altitude and differential engine power also are used for control.



TIPT-ENGINE, COMPOUND helicopter simulated on simulator speeds of up to 300 kt. in an airplane and 125 kt. in a helicopter. The helicopter has a gross weight of 55,000 lb. Rotor control cues during airplane flight.



HEAVY ASSAULT HELICOPTER, similar to the Sikorsky CH-53 but with twin tail rotors, was flown by simulator flight path control on a simulated auto-stabilization system. Auto-stabilization was able to fly with precision regardless of a human in duplicate.



V/STOL SIMULATOR gives pilot view pictures with dual control analog altitude reference. Goal pattern appearing forward screen and tilt to give the impression of altitude. Cues as reference point for the aircraft's nose appear in target to which aircraft would move. Simulator has standard airplane and helicopter controls.



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FIG. 1

■ Low rotating speed and closely held clearances between the two Geocolor elements assure high volumetric efficiency in operation.

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FIG. 2

be mounted on a single shaft and actuated on a single AN pad to perform multiple pump functions: fuel, oil, water, bleed, etc. (See Figure 2). Such compactness allows the pump to fit "tailwheels" in a tight hole at wing end frequently the wing may be part of the pump housing.

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DUAL CONTACT ANALOG SYSTEM is fitted onto the cockpit of the simulator, which is a standard S-61 cockpit taken directly from the Sikorsky production line at Stratford, Conn. Transmitter window openings, added after photo was taken, add to illusion of flight.

the rotor began to go into autorotation.

Black flying was controlled by wing flaps, which allowed a wide variation in the angle of attack flow, until the complete transition is made. As the rotor comes back over and around a disc outside from one-tenth to the blades. The governor changed angle of attack to hold airspeed and reduced the flapping.

In the full airspeed mode, the rotor controlled about 20% of the lift and the wings about 80%.

Rotor speed in autorotation dropped to 163 fpm.

By projecting various figures on the cockpit window display, including a scale, a north reference, a pitch up and a square, it was possible to fly the simulator more accurately and held to a given flight path.

Final configuration flown was a post helicopter, similar to the CH-53A but with a different tail rotor, equipped with an Auto Flight Path System.

This created a "windy" in regard to the transverse motion which is used for visual reference in the simulator. As the helicopter moved, its progress could be seen in relation to the predetermined mission path which was represented by the roadway.

The aircraft in this manner was an auto-stabilized aircraft, with the helicopter moving from a lower point where it had landed its nose raised but to a second point where another disk could be made.

Flight path called for acceleration from lower at a constant rate until a speed of 59.1 ft/sec was reached, then a pullup at 1.27g until a rate of climb of 1,978 fpm was reached. Climb and

speed were to be maintained until an altitude of 462.5 ft was reached, and then a pullup to level flight was to be made, holding speed and a constant 7.6g until the rate of climb became zero.

The helicopter was then to accelerate at 5 ft/sec squared per second until it was flying at 118.6 ft/sec. This time was to be held for 10 sec and then the helicopter was to reverse the entire procedure, decelerating, descending and finally coming to a hover for its second check about 14,750 ft from the starting point.

In practice, this simulator requires very slight control movements, especially in acceleration, pull up and pushover. It was impossible to do these but enough to follow the roadway which appeared on the analog contact television screen.

The roadway appears much like a conventional surface highway, except that it is white with a dark stripe in the center. The roadway changes direction in three dimensions to give direction to the pilot.

Even though the simulated flight path was known in advance, it was still impossible either to hold the required acceleration or to create the pullup and pushover rapidly enough to stay with the highway.

Sikorsky test pilot also reported they were unable to stay with the roadway for any significant length of time. The automatic flight path controller followed the roadway only, however, maintaining the helicopter in the center of the roadway.

The flight path, as depicted on the contact analog screen, is simply a

backup system to permit the pilot to continue the mission if the automatic flight controller fails.

In normal operation, pilot looks into the controller the joystick mission, then serves as a monitor while the controller flies the aircraft.

In the screen down, the controller was designed to maintain the desired mission profile with a maximum error of 1 ft. at any one time.

Automatic flight controller has been developed from the simulator and the helicopter was flown manually. Here, again, the helicopter was easily controllable, as was the simulated helicopter, but the lack of the vision was this usually an associated with helicopters made it difficult at times to hold a given attitude at flight conditions.

Simulator is located in S-61 cockpit taken directly from the Sikorsky production line at Stratford, Conn. It has been converted to a complete tank and a dual contact analog cockpit tube television display for visual reference.

The simulator also has a speed and movement panel in the cockpit with a dual set of functional flight instruments.

Control monitor console, placed in front of the cockpit, has a third set of flight instruments and a contact analog cockpit tube repeater. Both the cockpit movement panel and the visual outside panel have a set of exposure windows giving such data as degree of flapping percent in the rotor blades, etc.

Computer bank which directs the simulator is composed of a US-6000 for Burdette Electronics Analog Repeater Equipment (RASE) analog computer and a Digital Equipment Co. PDP-11 digital computer, which are located by Puckettville analog-to-digital converters.

Contact analog displays are placed in front of each pilot's seat and are designed to provide him with a horizon line and a moving grid for angular and translational cues to enable the pilot to



RIGHT TURN by the aircraft being simulated is displayed to the pilot by a tilt of the grid pattern superimposed the road. Demand display "sheds" are stationary and attached to the grid pattern rather than the aircraft.

PROBLEMATIC RECREATIONS 177



For what values of n is $13 \times 14^2 + 1$ prime?

—Conrad

Well, let me give you a few weeks, if you may, about Edmund Emerson, a new entry in our newly-faceted Random Division. Emerson-Emerson is engaged in the research, development, and manufacture of radio altimeters, microwave radars, sensors, surveillance, and communications equipment. Need any? Call on this new Littleton facility in College Park, Silver Spring, and Prince Frederick, Maryland, and Washington, D.C.

ANSWER TO LAST WEEK'S PROBLEM: 493 herbaceous are taller and heavier than their stems.

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CONTROL CONSOLE for the simulator (in background) has control analog reports and displays set of instruments received from simulator adjustment panel. Non patchboard at left, one of five used in the system. Four others are on the computer bank.

viding a safety backup. This arrangement makes the simulator capable of variable stability instrument display flight research.

Control research system was designed and built by the Nondes Division of UAC at Norwalk, Conn. Work on analog began there about eight years ago, and considerable work has been done on control analog displays for Navy submersibles. Work on helicopter and aircraft displays was first begun under auspices of the Army-Navy Partnership Program (ANPP).

System centered on the simulator has an attached data functional generator which provides a horizon line, a moving grid to simulate the earth and stationary clouds, which are as realistic as possible appearing, rather than velocity cues for the pilot.

Vertical half of the integrated, single cube display gives altitude and plotting

information and the horizontal half gives navigational information, somewhat similar to FPI radar displays. In addition, maps and other navigational equipment may be installed. Object rate attitude tube display was chosen for the simulator over the heads-up type display which is projected on the windshield, since it provides more freedom of display. The tube can have a variety of workings, such as a + or a - used as speed compensated on the standard grid.

These can simulate the horizon reference of the aircraft's nose, cockpit, flight profile path (sightlines), landing zone, height, or virtually anything else desired.

Possible adaptation which may be added to the standard analog system is a terrain clearance adapter from a Norden MAP-31 radar to provide range profiles.

Computers and associated equipment are fitted with removable patchboards which are made up in advance for each type of V/STOL aircraft to be simulated.

Total of five are used in the system—on the control executive console and four on the computer bank. The patchboards are made up to link the computers together to solve the particular matrix equations for each type of aircraft.

Equations are derived prior to flight simulation and the patchboards make up to fulfill the needs of the computers in solving them.

Change of patchboards, therefore, allows the flight and performance characteristics of the entire simulator to be instantly changed. Since the patchboards

can be unplugged and replaced rapidly, they allow quick simulator conversion from one type of V/STOL to another. Skolder claims the analog computer system is sufficiently accurate to compete with digital computers. The computer, in fact, hides the analog nature in possibly the most sophisticated simulation equipment in existence.

Use of these high-accuracy analog computers allows the simulator to determine actual aircraft performance and obtain sub-number data for design engineers.

In addition to engineering studies, the simulator will be used for human factors work and will also study different types of aircraft, including side and rear viewable types.

When the simulator is used to investigate automatic flight systems, a digital computer will be coupled with the analog for the need.

The analog computers, in this instance, will be able to predict aircraft performance while the flight is being simulated.

Hardware for the research work will be produced by the various divisions of United Aircraft, and an effort will be made to tie all of them into the research program in one possible production order should result from the work. Other firms, however, could not be attracted from leading on production work.

Aircraft 'Dress-Up' Waste Cited by GAO

Washington—Air Force wastes at least \$16 million over a four-year period "to dress up aircraft"—mainly for the sake of appearance—the defense so long ago action under the military and program, according to a General Accounting Office report to Congress.

Aircraft are modified and repaired as necessary (IRAN) before being delivered to U.S. forces overseas. GAO explained in addition to IRAN, aircraft for foreign nations are rehabilitated "to look like ours," GAO said.

GAO's review covered about 25% of USAF's aircraft rehabilitated for the military assistance program during the 1958-61 period.

GAO was able to estimate from available records and documents with the contractors involved that at least \$16 million had been spent to dress up the aircraft for military assistance programs, GAO commented. The aircraft involved were Lockheed F-96C, North American F-100A, F-50Fs and F-56Ds, and Republic F-84Fs.

GAO concluded that the military assistance rehabilitation specifications required that aircraft "be finished to present a like new appearance not greater importance given to eye appeal."



SHARKEE CONVENTIONAL bombs, incorporating rotating fins, are shown fitted with fins extended and with fins retracted for almost mounting. Glideye module centers, right, mounted on rack on an A-1H wing, can be released singly, in a triple or in pairs.



Navy Develops New Aerial Weapons Series

New Navy series—"eye" designation—of fast-fall air-to-surface standoff weapons is being developed, generally intended for low-level attack missions in conventional warfare. The eye weapons are in various stages of development or testing at the Naval Ordnance Test Station, China Lake, Calif.

Eye designation was chosen because the weapons are aimed visually by the pilot.

Most sophisticated of the series unveiled to date is Walleye, a glide-bomb which will be equipped with an advanced homing guidance system. Still in the feasibility stage of development, NDTSS says Walleye's warhead is a high explosive type, effective against most types of hard targets.

Walleye weighs about 1,000 lb and may be used by medium, light attack and fighter aircraft. Walleye is believed to incorporate a version of a system called a pilot to direct it to the target by means of a TV camera display while the launching aircraft is making an pass (NAV Apr. 9, 1962, p. 12). It is an earlier developmental model, the Walleye tracking camera is used a television camera lens in an as-

sembled vehicle which could lock on an object selected by the pilot from the cockpit display, and then feed guidance information to Walleye's nock.

Three of the eye family recently shown at NDTSS were the glide-bomb weapons—Challenger, Rockeye and Sharkeye.

Glideye is modular in construction with seven personnel containers mounted on a speed lock or wing-bank which weapons attached to the plane. Pilot may elect to drop the container singly, in a triple, or in pairs. Typical payload weight is approximately 1,000 lb, and can be delivered in a box, dive or straight-and-level maneuvers. Aerojet-General Corp. has the production contract for this device.

The container is designed to operate from subsonic or supersonic speeds. For the NDTSS demonstration, container was loaded with inert payload pellets, which drove their killing power from aircraft motion and giving some Houston-Fulton Associates, Torrance, Calif., manufacturer the modular dispenser.

The second dispenser is Rockeye, a cluster weapon expected to be effective against personnel and armored vehicles. Each Rockeye contains 96 shaped-

charge bomblets, which are modified 2.75-in. rocket warheads. The bomblets are stacked around a Zero rocket motor, which disperses them after the Rockeye is released.

The third NDTSS developed dispenser, Sharkeye, is a low-drag, cluster bomb designed for delivery by all high performance aircraft equipped with single and multi-engine launch racks. Sharkeye, intended to disperse large quantities of explosives over a wide area, weighs about 750 lb, and can be delivered in a box, dive or straight-and-level maneuvers. Aerojet-General Corp. has the production contract for this dispenser.

Aircraft type weapon, a Sharkeye, a conventional bomb fitted with a retarding, parachute-type tail assembly, which reduces the minimum safe release weight. The Sharkeye parachute is carried in a collapsed condition and the pilot has option of using the weapon in a rippled bomb for penetration, or in a retarded bomb for improved accuracy or area saturation. Development members was subcontracted by Douglas Aircraft Co. Delivery of the weapon to the fleet is expected in 1964.

ACQUETE GLIDEYE-WEAPON, left, consists of 96 bomblets. Sharkeye (right) drops large quantities of munitions over wide area.





JULY 22, 1963

MANNED SPACE FLIGHT ISSUE

• The most important development of this decade, **MANNED SPACE FLIGHT**, will be the subject of the July 22, 1963 issue of **AVIATION WEEK & SPACE TECHNOLOGY**. **MANNED SPACE FLIGHT**, the major segment of the national space program, is planned at \$20 billion for a manned lunar landing. The total space budget requested for fiscal 1964 alone is a record \$7.3 billion.

AVIATION WEEK & SPACE TECHNOLOGY has established an unmatched reputation for detailed coverage of technical and industry developments on the plans, operations, facilities, budgets, organization and procurement policies of the national space program. Now, a task force of editors will concentrate on both civilian and military manned space projects in an issue devoted entirely to the subject.

Themes of the issue will stress future programs from Project Apollo to manned permanent moon bases, manned orbiting space stations and interplanetary Mars and Venus flights. Editorial highlights will include:

- Major progress report on Project Apollo, its hardware and technical developments
- Status Report on Project Gemini two-man spacecraft including joint NASA-USAF operations
- What we learned from Project Mercury and how it built a technical foundation for future manned space flight programs
- Technical needs of military in manned space flight, including Dyna-Soar, Aerospace Plane, maneuverable re-entry vehicles, inspection and surveillance satellites
- Russian manned space flight programs and technical progress
- New types of support operations required for large-scale manned flight including simulators, control centers, transport and assembly facilities, tracking and data transmission equipment, medical and life support

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Microcircuit Testing

New test and evaluation of new microcircuit components has been standardized. From Naval Air Development Center, Johnsville, Pa., to the Naval Avionics Depot in Crane, Ind. This work is intended to provide more personnel and longer facilities for Navy evaluation of new microcircuit designs.

Exposures to data at NADC indicates that measurement performance lags in semiconductor operations is not always reliable.

For example, high operating speed quoted for many flip-flop circuits is based on a very small lot size whereas a practical computer system is large. An assessment is being made of the extent to which speed, according to a Bureau of Naval Weapons quotation.

specifies the cost quoted by industry for a conventional circuit design.

Because NADC used standard Test Instruments Series 51 microcircuits, about 150 in all, which already had undergone extensive environmental and stability testing, the NADC data had passed qualification tests only. And because the microcircuits used in the test were in the experimental equipment, the transition is greatly accelerated with a minimum amount of additional design engineering. Lowell points out the estimates that 50-75% of the time normally required to design special circuits can be saved through the use of standard microcircuits if available ones are suitable for the job to be performed.

Test Time

In the microcircuit replacement program now under way in the Letter ASA-27 digital enterprise, the shift register circuit due to be substituted usually will use standard Series 51 non-volatile devices. In addition to extensive successful test time by Test Instruments, Letter has accumulated a total of one million device hours in the shift register application in which they will be used without a single failure, according to Lowell. Letter did encounter some knowledge of microcircuit encapsulation originally due to its choice of epoxy resin used for encapsulation of the plug-in card, but this is not charged against the microcircuit manufacturer.

Lowell says the substitution of non-volatility in the 66 sub-elements of each ASA-27 computer, out of a total of about 2,600 plug-ins each in the machine, will save the Navy \$14 million in direct production costs on the Fiscal 1966 procurement quantity. If microcircuit costs come down, as Lowell expects, he predicts that cost savings should add to 50% compared with conventional

vertical burn-in capacity within two years.

Letter has adopted three other types of ASA-27 circuit functions in microcircuits. However these functions require use of new standard microcircuits which has not yet undergone sufficient tests to assure their reliability. When they are qualified, approximately 35% of the total ASA-27 capacity can be converted to microcircuits.

No Cost Increase

Under the terms of the BeWays program to adopt microcircuit functions on a piecemeal basis, the substitution had to be accomplished without increase in equipment cost as part of Navy's reform improvement program. This meant that all development and reliability test costs had to be absorbed over a single year's production. This could be done as the shift register, which used standard Series 51 series circuit, but the much longer test time required for newly developed microcircuits needed for the other three types of ASA-27 plug-in cards was paid too expensive to amortize in this time.

Recognizing that these newly developed microcircuit functions should find use in other Navy electronic equipment, BeWays plans to use research and development funds, if necessary, to make sure cost of extensive qualification testing, possible in the microcircuit manufacturing plant.

The same guidance has been emphasized in Letter's efforts to substitute microcircuits in the company's AN/



Smallest Trademark

World's smallest trademark is claimed by Westinghouse Electric. It is a circular "W" which appears on each microcircuit microcircuit produced by the company. The trademark, seen through the eye of a microscope at 30,000 times, is a small circle with a "W" in the center.

ASQ-61 bombing navigation computer and in the A-4A (A-1) where more than 100 functions could not be provided by standard devices. However, Letter's efforts to date indicate that most of the work of the active-duty engineers (ALC) in this category can be converted to microcircuits since the devices have passed reliability qualification tests.

During reliability problems, Lowell believes that separately designed test programs will demonstrate reliability of newly developed microcircuit devices and permit their substitution in the ASA-27 and ASQ-61 to get under way during Fiscal 1964.

Exposures to data suggest that newly developed microcircuit functions are fully as reliable as standard circuit functions since production techniques have been studied and sufficient production experience has been obtained, Lowell says.

ONR Sponsors Laser Research Programs

Los Angeles—A series of small optical mass research and development programs to explore new and improved materials, and in a longer design, to develop laser components and processing techniques, has been approved by industry research by the Office of Naval Research.

To date, much of ONR's laser activity has been concentrated in high energy ruby and neodymium doped glass devices and in improving research on these two high-power laser materials in an examination of their potential use in various weapons (AW July 9, p. 42).

Comprehensive ONR program includes:

- **Neodymium pumped lasers**—Feasibility of directly pumping a laser line with an excitation source such as alpha, beta and gamma rays and possible extension, will be investigated by MIT Research, Newport Beach, Calif., under a \$75,000 contract. Direct coupling to the laser medium without having to go through the intermediate step of pump generators could prove to be an important advance for the technique. An Avco Automotive Systems Div. has a similar development contract (AW Aug. 22, p. 54).

- **Expanding the Q-switch**—Research on expanding the Q-switch and mode select for laser systems will be conducted by Technical Optics, Inc., Burlington, Mass. A Q-switch is a device used by holding up high-power to permit laser. Technical Optics has been working on a technique for placing a thin film in the optical path of the laser and a laser cavity having to allow the laser

film and power energy to be released in a single pulse.

- **Flash lamp design**—An effort to develop for an extra flash lamp on an optical generator design. Research will be done by the Army Medical Corps under a contract to P. E. Lee, Inc., San Jose, Calif. Both ruby and neodymium doped glass have been optically pumped with laser flash lamps.

- **Liquid laser**—Progress in improving and developing laser using rare earth chalcide materials is under way in General Telephone & Electronics Laboratories under a \$60,000 contract. General Telephone internally approved a liquid chalcide laser during the early part of this year.

- **Deposited materials**—General Telephone plans a research program on fluorescent organic materials. This will be in addition to ONR's supported work on organic at Brooklyn Polytechnic (AW Mar 26, p. 34) and the General Telephone chalcide effort.

- **Materials research**—Search for new laser materials will be conducted in separate program by Kodak Corp. and Loral Co., both subsidiaries of Union Carbide, with the latter's emphasis on the growth of crystals using various techniques. Radio Corp. of America's DuPont Research Center, which has been doping rub crystals with various rare earth elements, will conduct research on laser crystals doped with various activators. A research program on fluorescent ion attraction in laser materials is planned by Sperry Rand Research Center, Astoria, in conducting research with ONR to conduct research on the growth of laser crystals doped with various activators.

- **Rayproof ruby and glass**—Loral will conduct research on the growth of high energy ruby crystals and Argonne Optical has agreed to make funding to conduct its efforts to improve the growth of neodymium doped glass (AW July 9, p. 42).

- **Scintillator films**—Research on suitable optical films suitable for laser systems will be undertaken soon by the Laser Science Center of Los Angeles, Inc.

- **Nonlinear effects**—Nonlinear effects caused by the interaction of various laser beams with each other will be investigated under a \$44,000 contract by RCA's David Sarnoff Research Center.

Other contracts in the field of laser research recently by government agencies are:

- **Geometric measurements**—Ridgway, Geo. Inc., and Geo. Inc., will conduct research on the design and fabrication of laser line in geometric measurements under a \$19,551 contract from USA's Research Service, Inc. Under a \$10,000 contract from USA's Research Service, Inc. will explore possible products use of

an optical beam as an earth satellite.

- **Long-range communications**—Federal Communications Commission is conducting an investigation of selected optical propagation systems in the long-range communications systems in air and space for Remote Air Development Center under contracts totaling about \$13,000. Part of this work centers on an investigation of the transmission medium for long-range optical communications systems in air and space for Remote Air Development Center under contracts totaling about \$13,000. Part of this work centers on an investigation of the transmission medium for long-range optical communications systems in air and space for Remote Air Development Center under contracts totaling about \$13,000.

The company is examining a beam waveguide to channel the optical energy.

- **Fiber optic laser**—Aerospace Optical Co. will develop laser integral to opti-



A Miller 50B-150 in the "Money Finger" at Motorola Electron Tube, Des Plaines, Ill.

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• **Bathfield laser uses—General Electric** is continuing work on a variable pulse-width laser transmitter under an extension of an Army Missile Command contract (AW Apr 72, p. 58). RCA's development of bathfield laser range finders, supported by \$445,000 in Signal Corps contracts has been extended again.

• **More extensive effects—Research on infrared analysis and molecular diagnostics over the 2.55 micron region will be conducted by the University of Dayton Research Institute under a \$95,400 contract from USAF's Aeronautical Systems Div. The one of the most sensitive indicators for determining spectral spectra of low molecular weight compounds will be investigated by Air Force Research Foundation under an • **Laser Correlation in Atmosphere—Army Research Office** is contemplating an award to Technical Operations for a theoretical correlation study of atmospheric density variations in a coherent light generated by optical waves. Atmospheric turbulence might impede use of sophisticated optical radar and communication systems in the earth's atmosphere.**

• **Laser Measurements Survey—Wheeler Laboratories** is conducting a university laser measurements study for Basic Air Development Center under a \$23,625 contract.

• **Laser Satellite Communication Technology — Westinghouse** will explain modulation reducing retroreflectors in optical systems, a technology for laser communication, through an earth satellite under a \$62,000 contract from NASA. A panel effort is being conducted in Princeton (AW Apr. 22, p. 44).

• **Lower Ground-Space Communication** has received a \$100,356 applied research contract from Aeronautical Systems Div. in support of its laser ground development (AW Feb 11, p. 95).

Microwave Generation

Discovery that microwaves can be generated by passing an electric current through a small block of gallium nitride at room temperature has been reported by International Business Machines Corp.

Credits of the semiconductor material, smaller than 0.02 cm, have generated frequencies ranging from 0.1 to 6.5 ps (mic) with peak power of as much as 1 watt 1 ps.

The overall efficiency achieved to date is 1.2%. Only a pulsed operation can be obtained so far, but CW operation at room temperature should be possible, according to J. B. Gunn of IBM's Thomas J. Watson Research Center. Gunn described the phenomenon.



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Booster Ignition by Laser Studied

Research at United Aircraft Corp.'s United Technology Center indicates that a highly energized beam of coherent light from a laser could be used to ignite large solid propellant motor boosters.

The technique would use a mirror and an optical lens to focus the laser beam on the rocket igniter. At the moment of contact, the igniter would fire, causing rocket combustion.

The technique is also applicable to combustion ignition of clusters of solid boosters, according to Dr. Don A. Rains, who directed the UTC research. Ignition of a multibore cluster motor could be achieved with a single laser beam split optically by prisms or by a set of laser beams triggered and pointed by a single mirror.

One advantage claimed for the laser technique is that it permits the booster's ignition starting volume to be mounted independently on the launch pad, rather than having to be mounted to the booster externally or internally.

The sensitive timing operation of a conventional electrically ignited rocket motor would be eliminated because it would not be necessary to use a laser-linked igniter UTC claims.

Major possibility is also associated with the laser technique, UTC says. Shocks, noises or other optical blocking equipment could provide protection against misfires and be removed just before firing.

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Expanding Laser Effects Research—Focusing on the development of a laser optics experiment to be carried aboard a Servitor soft lander vehicle will be developed by Marshall Laboratory, Torrance, Calif., under contract to National Aeronautics and Space Administration. The experiment, designed by Goddard Space Flight Center, will measure the mass, velocity and the direction of ejection of aerosol particles thrown from the surface of the moon by expanding microdroplets. These aerosol particles, of various sizes, could prove to be useful to astronauts on the lunar surface. This might also be an experiment or aerosol based for aerosol spread and control parts, such as aerosolizers, removers or other cells (JAN 14, p. 54). Contract is for \$257,500.

Flight Tests Due for Two Vehicle Testing—Techniques A special vehicle test, known as the "vital", is capable of accurately measuring a true vertical in sensor vehicles from the above plane, will be flight tested by the Air Force soon in a high altitude test. The instrument technique is being developed by Collins Radio for the Flight Control Laboratory of USAF's Aeronautical Sciences Div. Flight tests are expected to provide optimum frequency and positional accuracy of the technique.

Ground-to-Water Opportunities—Aeronautics companies looking for challenging new business opportunities should be aware of requirements for launch and gantry vehicles tested recently by Ames Research and Development Laboratory, Fort Belvoir, Va.

Qualified sources are being sought to develop techniques for detecting and locating, in three dimensions, a portable detector for unattended ordnance and a similar one which can be carried by a helicopter. Interested firms should contact Ames by July 19.

Building Checkpoint Reported—Integrated helicopter avionics system (IHAS) contract to be awarded soon by Bureau of Naval Weapons will require that the system contain complete built-in provisions for checking performance and isolating faults without use of external ground support equipment.

New CW Laser

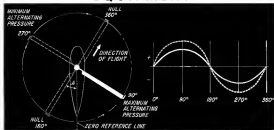
Continuous-wave injection laser which operates continuously with a power output of more than 1 w., a 100-mw demonstration unit of the highest CW power level achieved previously with ruby and laser, has been demonstrated by General Electric Research Laboratory scientists.

The new device exhibits an efficiency of 30 MHz when operated at a temperature of 200 K, but also operates at somewhat higher temperatures. Coherent light contains over 8,000 Angstroms.

The new CW laser operation was achieved by injecting a laser cavity diode with intensity that decreases and scattering it with another piece of gallium-arsenide which serves as a heat conductor and electron reservoir. Development is currently supported by USAF's Chugach Research Laboratories.

Sample of the new CW injection laser will be available within two months from GE's Research and Development Dept., Syracuse, N.Y.

EQUIPMENT



HELICOPTER TRUE AIR SPEED INDICATOR—constant fluctuations in blade lift or pressure induced by horizontal motion, regardless of heading, left. Highest pressure when probe is facing flight direction and lowest when turned away, from high and low points of a sine wave, right. Magnitude of the wave increases with wind speed, dotted line in right. Blade lift also can show phase with sine reference line to give directional data (angle XL) which combined with magnitude, can be displayed as longitudinal and lateral speed components.

Helicopter Speed System Accurate to 1/2 kt.

By Ward Wright

Caltech's No. 1—Helicopter true air speed indicator, with a range of 4 kt. to 150 kt. forward and 4 kt. to 40 kt. in all other directions, is being proposed to contractors bidding on the crucial air data component for the Navy's 100X heavy lift helicopter.

The indicator, built by General Controls Corp., New Jersey Div., here, under subcontract from Caltech Aeronautical Laboratories, is new in its approach to the very problem of accurately measuring helicopter air speed below 40 kt. and in directions other than forward. Current equipment below the true speed indicator often advantageously in helicopter performance in the following areas:

- Increased safety for commercial operations, particularly over crowded downtown areas. Since conventional pitot-static probe misalignment selection, do not give reliable readings below 40 kt., operators often try to under-read to prove safe. A reliable pitot-static probe around the head rotor's swirl area, regardless of air speed and before landing. Don't cut a corner as known in helicopter pilots as the air speed beginning a few feet off the ground and extending to the maximum altitude needed for a safe maneuvering landing.

A characteristic of this area is that horizontal speed affects the altitude

needed for a safe emergency landing. Increasing the forward speed will lower the emergency altitude needed for a safe emergency landing with the helicopter at low enough to avoid damage.

Knowing the horizontal speed component accurately down to 4 kt. regardless of heading, General Controls, pilots will find it easier to operate safely, the danger zone.

• Anti-collision warning. For effective operation, a true warning will need to be measured while the helicopter is hovering. In other words, Doppler radar, presently used to establish whether a helicopter is hovering, can be unreliable (JAN 14, p. 36). General looks to use a new indicator accurate down to 4 kt. will set the pitot.

• Backup longitudinal air. A Doppler navigation gas ground speed and drift angle. It is because unreliable the true speed can be combined with the last reliable data to give a reasonable present ground speed for descent maneuvering.

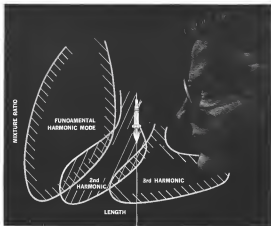
• Ability to fly without altitude. Because the true speed indicator is not limited to measurement of forward air speed, the component—both lateral and longitudinal—of the flight vector are displayed separately. Knowledge of whether the helicopter's forward flight vector is not below component will give the pilot a basis for corrective control with a known of speed and range. In developing the helicopter true air

speed indicator, General has its roots in a design philosophy evolved by Caltech Aeronautical Laboratories several years ago under Navy contract. Essentially, the system derives true air speed from continuous measurement of air speed components at the blade tip.

When hovering, the speed at the blade tip consists of a blade rotation speed, an alternating pressure of much lower magnitude is introduced and superimposed upon the high pressure. This alternating pressure varies in magnitude relative to speed and changes position around the rotor disk, relative to heading and direction of flight. In sensing the magnitude of the alternating pressure, and relating its position on the rotor disk to the lateral and longitudinal air of the aircraft, true speed can be indicated regardless of heading.

To eliminate the long shafts in the pressure, and across the radial alternating pressure, General developed a low-noise rotor tip probe containing detector, probe, differential pressure transducer, and a pressure filter.

Tested pressure is fed into opposing ports of the differential pressure transducer—two port process pressure directly and the other pressure pressure through a pressure filter. The opposing flow rate pressure cancel each other out. What's left is a signal alternating pressure whose frequency depends on rotor





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For more information, contact: **BOEING AIRCRAFT COMPANY**, 3601 Airport Blvd., Seattle, WA 98148. Tel: (206) 426-3000. For more information, contact: **BOEING AIRCRAFT COMPANY**, 3601 Airport Blvd., Seattle, WA 98148. Tel: (206) 426-3000.

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AIR FORCE SYSTEMS COMMAND

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OPERATIONS RESEARCH ANALYST—Develops, through research, advanced techniques and methods for assuring the effective use of the management of military systems, development and acquisition and to develop solutions to complex management problems.

MATHEMATICIAN—Analyzes and evaluates missile guidance data, environmental data, biological and space reaction data. Develops efficient analysis studies. Follows up on collection and evaluation methods used and determine accuracy of the end product.

HEALTH PHYSICIST—Provides expert health physics consultation and staff services in dealing with hazards, hazards evaluation and monitoring of environmental factors as applies to nuclear and radiological problems of the Air Force. These programs include nuclear weapons systems and facilities, research and regular facilities and other systems and facilities.

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The Phantom, in service with the United States Navy, Marines, and the Air Force, can operate from short runways—even with bombloads of more than seven tons.

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